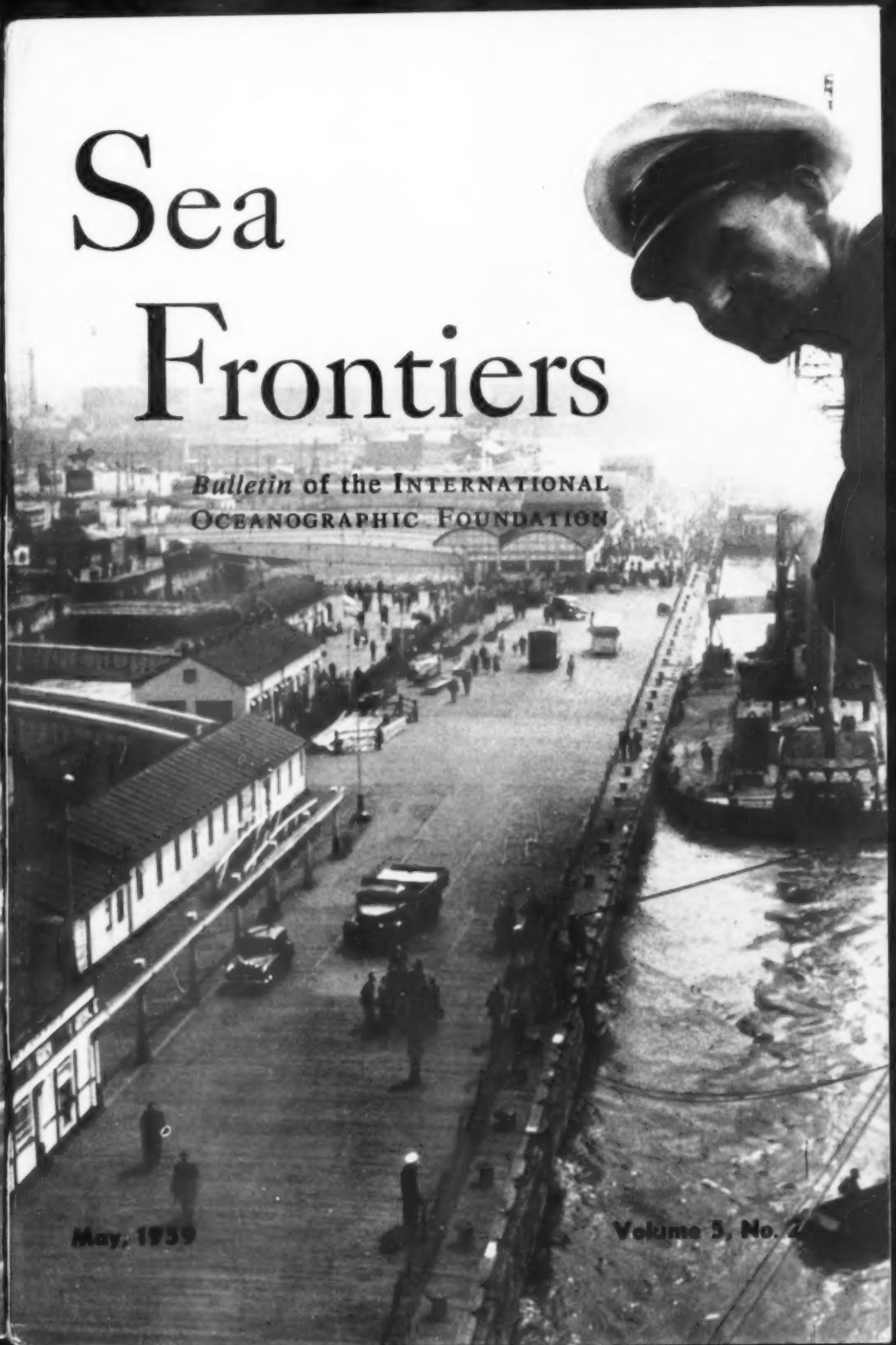
Sea Frontiers

Bulletin of the INTERNATIONAL OCEANOGRAPHIC FOUNDATION



May, 1959

Volume 5, No. 2

MEET DOCTOR FU MANCHU. *This close-up of a remora resembles a Chinese character, but it is really a fish, one of the most curious in the sea. The remora is a hitchhiker, attaching itself to other marine animals—sharks, sea bass, rays—by a disc on its head that acts like a suction cup. (United Press)*

FRONT COVER. *Sea lanes are still vital to world commerce and continue to carry the bulk of world trade, despite the extension of air travel. So it is essential that shipping be protected in war and peace. Here a big ocean liner is being warped into pierhead at Liverpool, England. (British Information Service)*

BACK COVER. *Puerto Rico is coming into its own as a Mecca for game fishermen. Esteban Bird, of San Juan, watches as Dr. Carlos Iturriza fights a 196-pound blue marlin during the Puerto Rico Invitation Game Fish Tournament, September, 1958. Because it is difficult and expensive for scientists to obtain good specimens of such large deep-sea game fish, sport fishermen can be of considerable assistance to scientists by supplying data as to size, weight, place and date of catch. (Puerto Rico New Service)*

SEA FRONTIERS

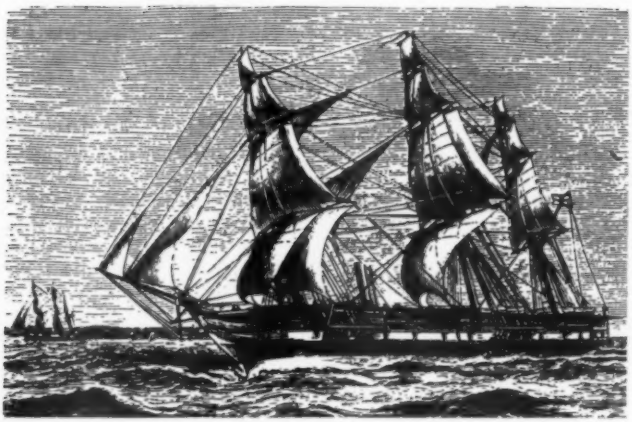
Bulletin of the INTERNATIONAL OCEANOGRAPHIC FOUNDATION

Editor: F. G. Walton Smith
Associate Editor: E. John Long
Managing Editor: F. May Smith

Editorial Office: The Marine Laboratory, University of Miami, Coral Gables, Fla.

Published Quarterly. Copyright © 1959 by The International Oceanographic Foundation, Coral Gables, Florida.

Table of Contents



VOLUME 5, NO. 2 MAY, 1959

PAGE

Ten Critical Years ..... Editorial 66

Science and the Mermaid ..... F. G. Walton Smith 74

Oceanography and National Defense ..... E. John Long 83

Fish that Wear "Nightgowns" 93

New For Old ..... Paul S. Galtsoff 96

Florida Tarpon Swims to Louisiana 101

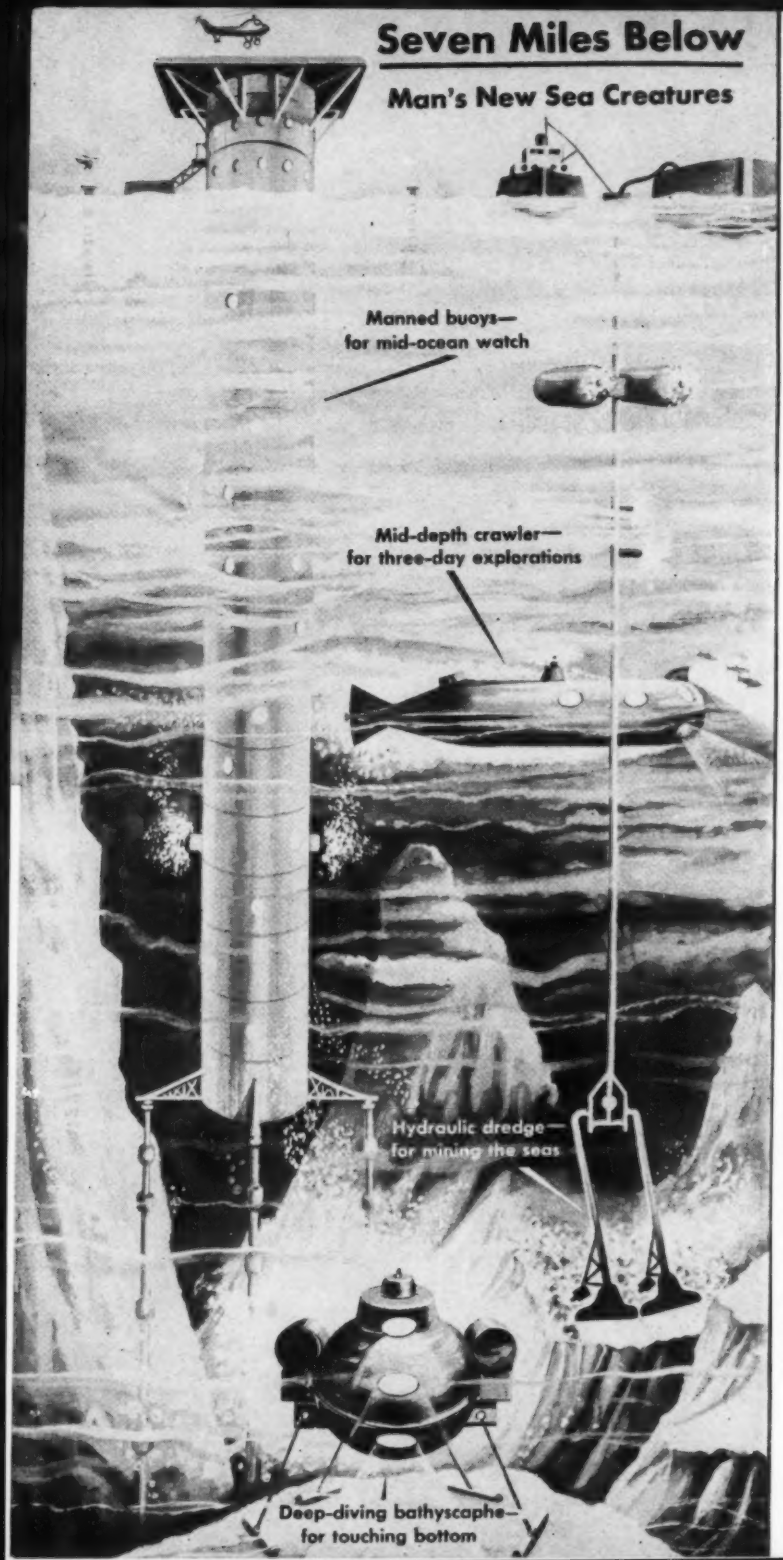
The Sea Serpent that is a Fish ..... Vladimir Walters 102

Marine Science, Soviet Style ..... Harris B. Stewart, Jr. 105

Puerto Rico Game Fishing ..... Donald S. Erdman and Erl Roman 114

Science of the Sea in Books 123

About the Authors 126



A COMPOSITE SKETCH *shows some of the new devices proposed for exploration of the last great earth frontier — the depths of the sea. The recent report of the National Academy of Science's Committee on Oceanography adds conclusive evidence to the contention that the key to man's survival lies in the ocean, not only for military mastery, but also food to support the earth's exploding population, for control of the weather, and even for clues to the origin of the human race. (Copyright* Newsweek. *Reprinted with special permission)*

Ten Critical Years

THE REPORT recently issued by a National Research Council Committee on Oceanography may well startle members of the public, of Congress and of the press, for it states with bluntness and clarity that the U. S. A. has been slow in its efforts to develop oceanography and that scientific research in this field is urgently needed to combat our greatest military threat as well as to safeguard future economic welfare. Viewed in the light of the fact that Soviet Russia is far better equipped to carry out offshore oceanography than any other country, the contents of this report must cause concern. The relatively small sum which it recommends be provided for the government to rectify the situation must appear singularly modest in these days of billion dollar ventures and expensive moon-reaching plans.

To members of the Foundation and other readers of *Sea Frontiers* these statements will not come as a surprise, since, from its inception, the magazine has drawn attention both to the importance of oceanography in our military and economic welfare and to the inadequacy of our present efforts. However, additional facts and figures, together with the recommendations made by the Committee, make interesting reading.

Both Military and Peacetime Needs

The vital part played by oceanography in naval defense is described in this issue, in an article partially based upon information released by the Navy. The report of the Committee summarizes this aspect by saying that, from the point of view of military operations, there is no comparison between the urgencies of the problems of the oceans and those of outer space. The submarine armed with long range missiles is probably the most potent weapon system threatening our security today.

But security from aggression is merely one of the results of an effective program of oceanography. On the practical side, the problems to be solved concerning the oceans are at least as urgent as those of space. Radioactive waste disposal, weather prediction and control, food for exploding populations, and underwater fighters, freighters and tankers are just some of the problems.

How many fish are in the sea? No man knows, nor do we know what determines the number of fishes in different regions, the quantities of plant and animal materials on which they feed, or what could be done to increase these numbers. We must learn these things if we are to help solve the increasingly acute problems of providing animal protein food for the growing numbers of underfed people in the world. According to *Newsweek Magazine,* the 47 million people added to the world in 1958 are equivalent to a country the size of Italy. Considering the position of the

United States in the community of nations, it seems appropriate, even essential, that we lead the way in this respect.

About a third of the energy of sunlight which reaches earth is used to evaporate sea water. There is good reason to believe that changes in the location where interchange of matter and energy takes place between sea and air affect persistent weather patterns. We know that the average weather conditions we call climate can change over a few decades, and we suspect that changes in the storage of gases and heat in the oceans will profoundly influence the process. Understanding of this is essential to weather prediction and control.

The seas present a challenge which in magnitude approaches that of space. At least we have been able to observe the moon, planets and stars directly with our telescopes. But the ocean depths, shrouded in darkness, have been obscured from our view. We know less about many regions of the oceans today than we know about the lunar surface. Yet we have learned enough to know that major features of the ocean floor—35,000 foot deep trenches; 2,000 mile long fracture zones; flat-topped undersea mountains; broad ocean long ridges; abyssal plains as flat as a calm sea — are uniquely different from anything either on the surface of the moon or on the land surfaces of earth. How and when were these features formed and why are they so different? These studies will tell us also much about the origin and evolution of life on earth.

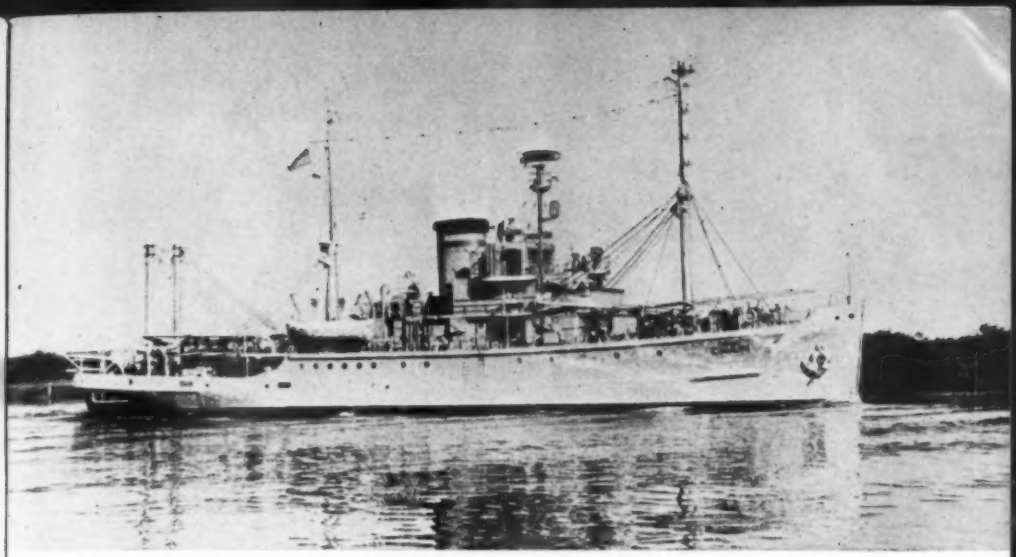
Increased Effort Urged

The Committee has found that relative to other scientific endeavor, progress in the marine sciences in the United States has been slow. There has been a substantial amount of excellent work, more often than not undertaken under extremely difficult and trying circumstances. But generally speaking, progress has not been rapid when compared with the essential and exciting information yet to be obtained by probing the vast and dark, but penetrable, depths of water which cover so much of the earth's surface.

In view of the complexities of these problems the Committee has recommended that the level of basic research in these fundamental areas be substantially increased during the next ten years. This will require increases both in manpower and in facilities. Of particular importance among the facilities are ships, which are to the oceanographer what cyclotrons or reactors are to the nuclear physicist.

Navy to Replace Inadequate Ships?

Our oceanographic research ships are inadequate. Most of the ships are old and outdated. Many are obsolete and should be replaced by ships of modern design which will be more efficient to operate and from which a greater variety of scientific observations can be made. In addition, the number should be increased. The Navy is cooperating in this phase and has set up a ten year program, TENOC, for providing the badly needed ships.



FIRST STEP IN THE U. S. NAVY'S *plan to expand the nation's fleet of oceanic research vessels was the conversion of the former salvage vessel ARS-20, renamed the USNS* Chain. *The* Chain *has been assigned to the Woods Hole Oceanographic Institution, which conducts marine research under contract for the Office of Naval Research and other organizations. (U. S. Navy Photo)*

Most of the new research ships will have an overall length of 204 feet and a full load displacement of 1,200 tons. There will be space for oceanographic wet and dry laboratories, a combined drafting room and study space, a small photo lab, and a combined chart and scientific instrument room.

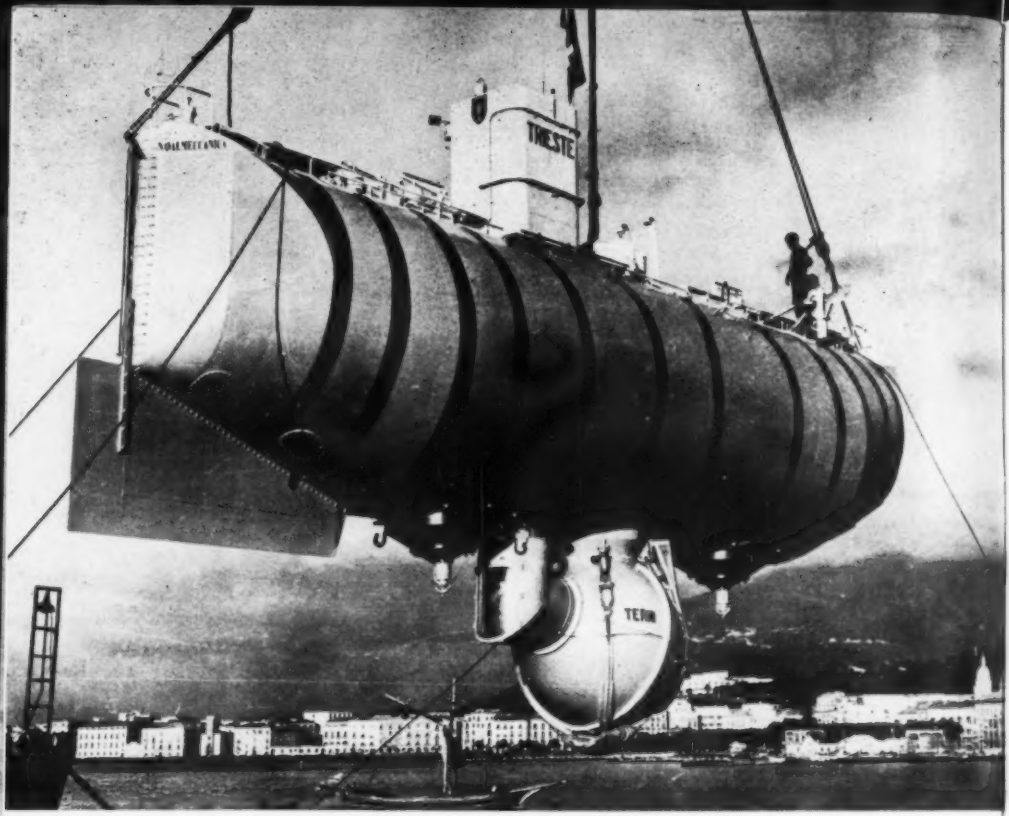
Deep Sea Winch and Boom

Each standard research vessel will be equipped with a deep sea winch and a boom over the stern, capable of supporting 50,000 pounds. Cost will be about $3,700,000, and each ship will provide for a crew of twenty-two, including officers and a scientist's complement of fifteen.

The TENOC Program also calls for a somewhat larger research ship, having a displacement of 2,000 to 3,000 tons. This vessel, requiring 29 officers and crew, can carry a team of 39 scientists, and will have a larger boom capacity. Major oceanographic research institutions which will receive ships under the TENOC Program include: Hudson, Lamont, University of Miami, Scripps, Texas A. & M., and Woods Hole.

Exciting New Approach

The oceanographer also needs improved instruments if he is to penetrate the water barrier and learn in detail about conditions at great depths. The Committee has recommended the establishment of a program of broad scope, aimed at developing and using new instruments and devices for exploring the sea. Using new deep-diving vehicles, for example, it is now possible for man to observe directly the ocean deeps. It seems highly likely that within the next ten years men will descend through the water nearly seven miles to the deepest point on earth.



CONQUEROR OF THE GREATEST DEPTHS. *The Bathyscaphe* Trieste *is neither a true submarine, nor is it similar to Beebe's Bathysphere, which was suspended on a cable. This unique research craft, capable of diving four miles and operating under its own power, has recently been acquired by the U. S. Navy to investigate areas scientifically and physically as mysterious to mankind as outer space. (U. S. Navy Photo)*

Modest Cost

As to the cost of increased research, the Committee specifically recommends that the U. S. government should expand its support of the marine sciences at a rate which will ensure a doubling of basic research activity within the next ten years. This must necessarily include increased training of scientists at those universities which have set up marine laboratories. Fellowships for graduate students are needed and professors should be added to the staff of teaching laboratories.

These measures mean new financial support. The Committee points out that about 23 million dollars were spent in 1958 on applied and basic oceanographic research. It calls for an additional expenditure of $651 million over the next ten years. The *New York Times* describes this as, "Indeed a very modest sum that we cannot afford not to spend."

Government and Private Initiative

The recommendations urge that the Navy, the National Science Foundation and other government agencies undertake to finance the minimum program outlined. But this is a *minimum program*. Action on a scale appreciably less would jeopardize the position of oceanography in this country relative to other nations, thereby accentuating serious military dangers and placing the U. S. A. at a disadvantage in the future use of marine resources. Greater rather than less than the recommended support is desirable.

For the greatest possible development of scientific initiative and imagination in this there must be room for the spirit of free enterprise as well as government sponsored study. It is therefore essential that private and industrial support be applied. The Committee urges that private foundations and universities, industry and state governments should all take an active part in the recommended program of expansion.

Part Played by Members

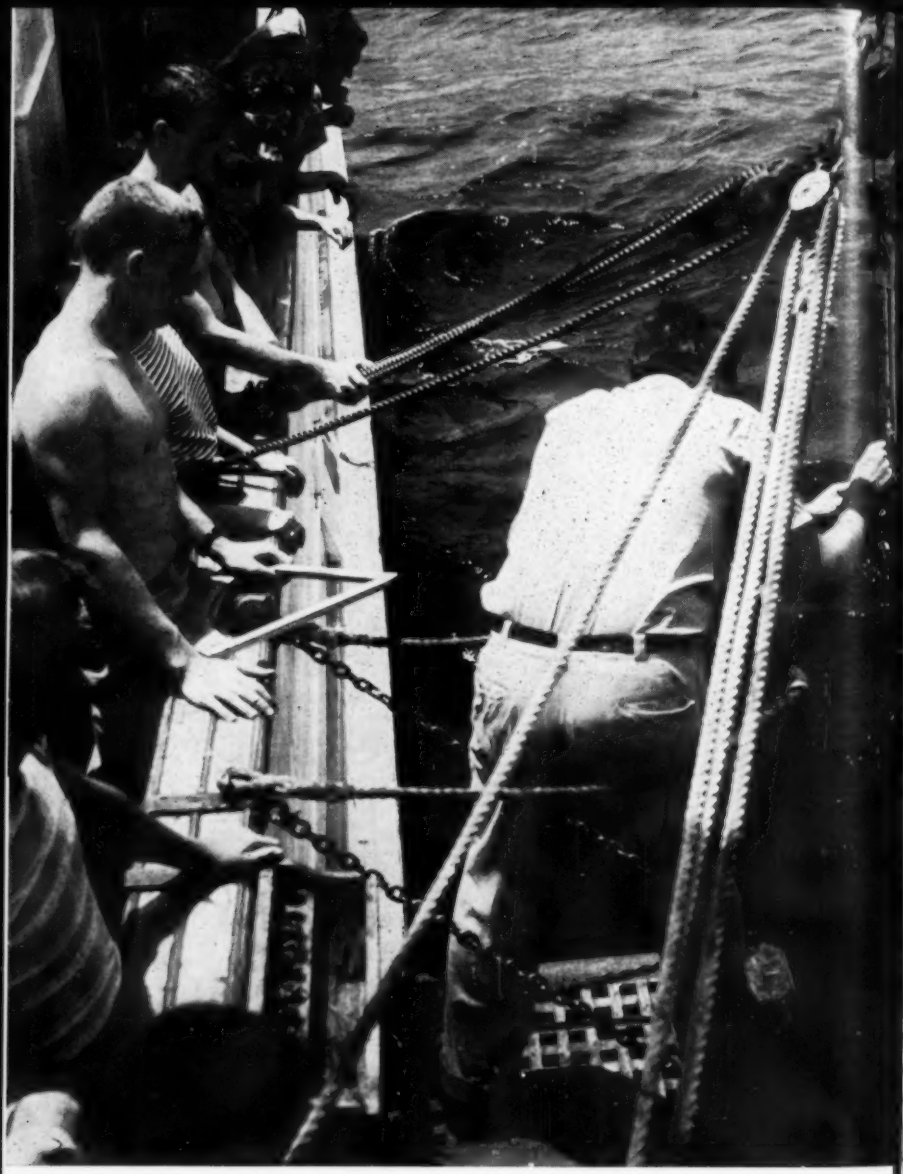
The International Oceanographic Foundation, founded for the purpose of encouraging and actively assisting in the development of marine science, believes that only through a partnership of business, government and the general public will a healthy growth take place in the use of biological, mineral and chemical resources of the sea. It will play its part to the fullest possible extent by continuing to supply its membership, and the general public and industry with authoritative articles on the progress of marine science over its broad range, from game fish to electronic fish-finders. It will also continue to the extent of its ability to apply direct financial support to teaching and research and to act as a catalyst in bringing together those who have a common interest in marine problems — scientist, laymen and industry.

What can members do? In the first place, of course, the dissemination of information is essential in a free community. The problems covered by the report of the Committee are sufficiently important that they should be brought to the attention of all who are interested in civilized progress, and not merely to those interested in the sea.

Members can help by bringing this article to the attention of others. Copies of the report may be obtained by writing to The Committee of Oceanography, National Academy of Sciences, Washington, D. C., directly, or to *Sea Frontiers*. Additional copies of the present article are available for distribution and will be mailed to members or to names and addresses provided, upon request.

This is Everybody's Frontier

Beyond the scope of government financing is that afforded by the direct support given by industry and private individuals, which can be carried out with various tax advantages allowed by the Treasury, either by the local support of individual research institutions or through the broader agency of the Foundation, such as



OCEANOGRAPHERS IN THE MAKING. *It is a shocking fact that, while the United States greatly needs marine scientists, less than a dozen trained oceanographers were graduated from educational institutions in 1958. Meanwhile Russia is turning out scores of oceanographic experts, trained on board the large fleet of Soviet research vessels. Here students at The Marine Laboratory, University of Miami, watch while an instructor lowers a Nansen bottle to obtain scientific data in the Gulf Stream. (Charles E. Lane)*

already provided by its corporate associates. Support may be given for specific research objectives, for educational endowments and student fellowships, as well as for the general needs of scientific organizations.

With increasing complexity of scientific investigation and organization our membership may take some personal satisfaction in its own pioneering efforts in emphasizing the ocean frontier and will certainly be gratified by the national interest in the ocean and its relation to man which is certain to be aroused by this Committee of distinguished scientists.

Chaplin Chair of Ichthyology

Marine research moved ahead another step in March when Mr. and Mrs. Charles C. G. Chaplin, of Haverford, Pa., granted the Academy of Natural Sciences, of Philadelphia, an endowment for the Chaplin Chair of Ichthyology. Dr. James E. Bohlke, associate curator, will be the first incumbent.

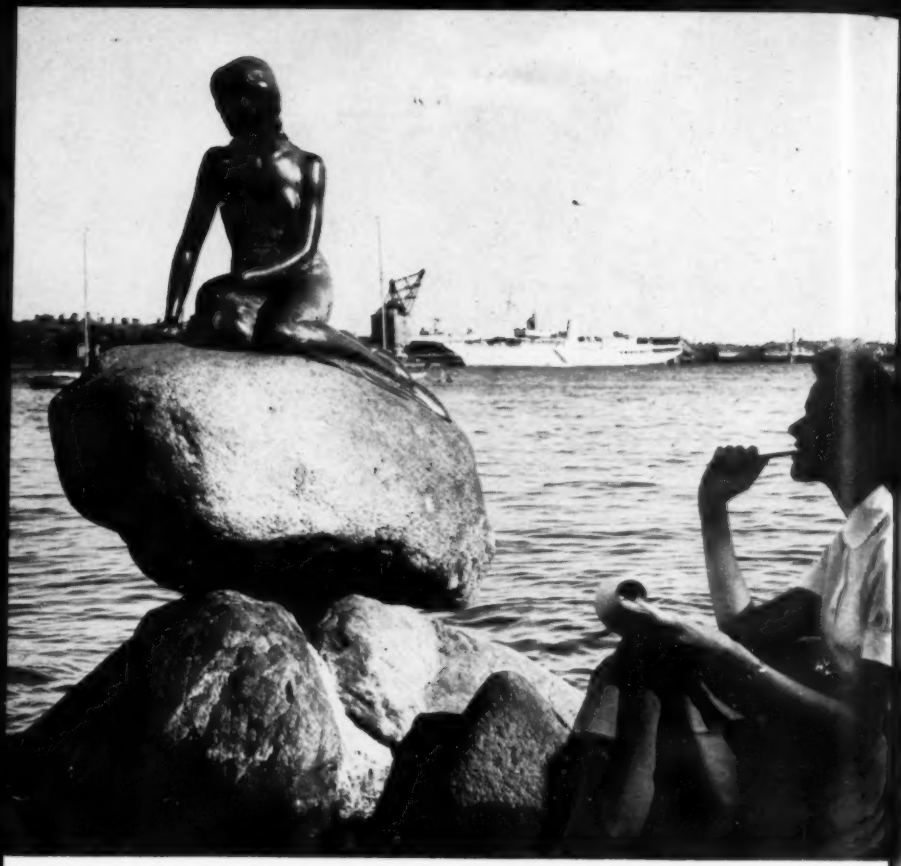
Since 1954, Mr. and Mrs. Chaplin have supported a program for the study of Bahama reef fishes at the Academy, and field work in Nassau, where the Chaplins have a winter home. Preparatory work has also been done by Mr. and Mrs. Chaplin and Dr. Bohlke towards the publication of a manual of Bahamas fishes.

Hurricane-Spotting Buoys

The Office of Naval Research of the U. S. Navy reports a new method of locating hurricanes, involving the use of anchored weather buoys. Under test by the Bureau of Aeronautics are methods of anchoring the buoys in the central and western part of the Gulf of Mexico, in depths up to 12,000 feet. Transmission frequencies, seaworthiness and reliability of signals are also being evaluated.

The buoys are designed to transmit for six months on a six-hour schedule without replacement of batteries. They are also engineered to withstand heavy seas.

If proved feasible, the new method will enable weathermen to detect hurricanes up to four days sooner than is now possible.



Science and the Mermaid

By F. G. WALTON SMITH

ONE OF THE MOST ancient of sea myths is that of the mermaid. Nevertheless, unlike the reports of sea monsters and sea serpents, which are still revived occasionally in one form or another, stories of the sighting of mermaids are far more apt to receive skeptical treatment.

Increasing accuracy of observation and reporting by seafaring people, and the widely accepted identification of mermaids with sea cows, animals well-known to science and sailors, undoubtedly are responsible for the failure of these romantic creatures to survive, except as admitted fables. Also, the rather vague accounts of sea monsters might conceivably represent actual, but unusually huge, specimens of creatures well-known to science—even those thought to be long extinct. But well defined descriptions of hu-

EMORIES OF ONE OF *Hans Christian ndersen's beloved fairy tales are re-illed by this beautiful statue of a mer-aid, near the Langelinie Promenade, penhagen. (Photo by courtesy of Car-lye and the Danish National Travel ffice)*

man torsos with tails of fishes can not be reconciled with the most elementary knowledge of zoology.

Rooted in Mythology

Marine biologists, and others aware of the sea cows, know that these mammals have characteristics of habit and appearance which might have started the mermaid legend, but the true origin may be far more deeply rooted in mythology.

We still listen to mermaid tales of pure fantasy, romantic legends of song and poetry as opposed to accounts of supposedly factual observation. They vary greatly. The teutonic mermaid has even lost her fish tail, though she has a feature typical of many legendary creatures—the ability to reveal the future to human acquaintances, as she does in the Nibelungenlied.

Supernatural Powers?

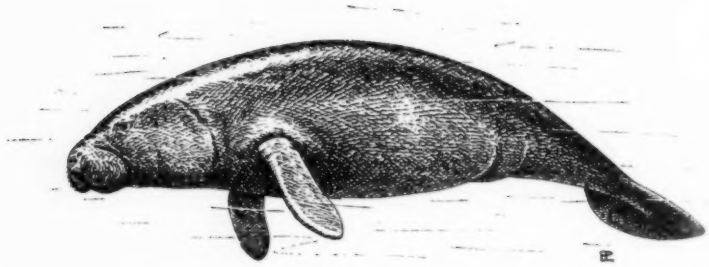
Old English tales credit the mermaid with the ability to confer supernatural powers upon favored humans, or to protect or avenge them. Another characteristic theme, from the French, is the mermaid Mélusine, who falls in love with a human being and lives as his wife, only to return to the sea when he breaks his faith. Danish ballads tell of the mermaid luring her human lover into the sea to live.

Beyond these legends, still existing but classed as fairy tales, there was a time when men really believed in the existence of mermaids and it has been suggested that "factual" accounts by sailors, later repeated by the biological writers of those earlier days, provided the basis for the mermaid of poetic fiction. Not only sea cows but also sea otters, seals and walruses may conceivably bear a near resemblance to human beings swimming in the water, especially at a distance, but they appear to have played a minor role in the development of the legend.

Columbus Saw Them, Too

Christopher Columbus, for instance, relates that when off the coast

FROM AN OLD FRENCH LEGEND, *Mélusine, comes a double-tailed mermaid. In 1387 the Duke of Berry ordered his secretary to collect all available information on this elusive and fascinating creature. The illustration is from a carving on the church of Pucé, in the Gironde, France. (From S. Baring-Gould* Curious Myths of the Middle Ages, *1897)*



CHRISTOPHER COLUMBUS *described "mermaids," but they were very likely the manatee* (Trichechus manatus), *a common mammal found in American rivers and coastal waters from Brazil to Florida, and along the west coast of Africa. (Photo courtesy of the Smithsonian Institution)*

of Hispaniola, or Haiti, early in January, 1493, he sighted three mermaids who lifted themselves well up in the water. His journal goes on to relate that ". . . they were not as beautiful as they had been painted, although to some extent they were like a man in the face."

Columbus recalled that he had seen similar creatures off the west coast of Africa. This gives us the clue to the true nature of his discovery, since the manatee, or sea cow, of the West Indies is also found off the west coast of Africa and moreover, though capable of appearing human at a distance, possesses a decidedly repulsive face. The arms are paddle shaped flippers and they bear rudimentary nails, suggesting lost digits. Mermaid-like, it has lost its hind limbs during the course of evolution. But the tail is not the fish tail of legend. It is a powerful rounded paddle flattened from above down, and is the principal means of propulsion.

Big City Mermaids!

Manatees are still fairly plentiful in Central America and even in Florida, where they are occasionally seen in the Miami River, in the middle of Miami, a city of several hundred thousand people. At such close range the face can be seen clearly and any resemblance to human beings is, alas, immediately dispelled. It has a large bulbous snout with short white bristles, very small eyes and nostrils closed by valves. The resemblance, if any, is to a cow or pig.

Sea cows are probably descended from land grazing animals such as the cow or elephant, in fact, and have followed a similar line of evolution to the whales and porpoises. Whales and porpoises, however, are descended from flesh-eating carnivores and sea cows are no more related to porpoises than sheep are to lions.

Suckles Its Young

The manatee, found in shallow water close to shore or in rivers, in West Indian waters from Florida and the Gulf of Mexico as far south as the river Amazon, never leaves the water and feeds upon sea grasses, some-

times even upon the land vegetation overhanging the stream or lagoon. To this extent the name sea cow is well applied.

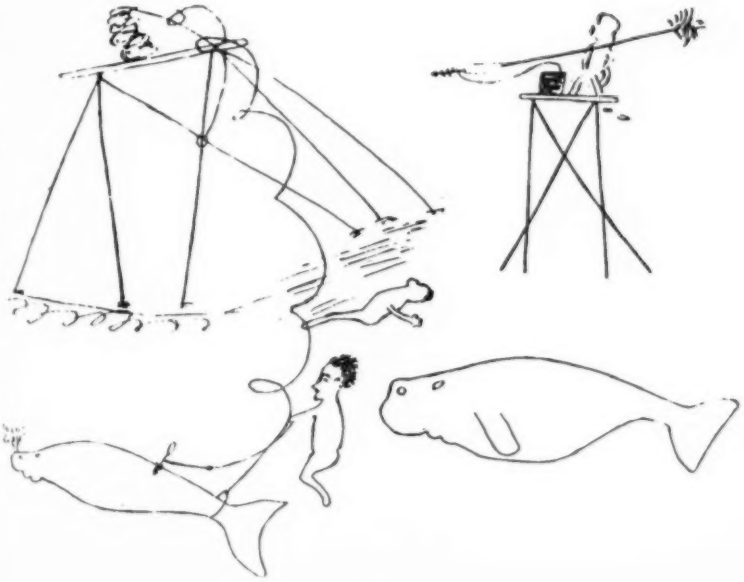
But in other ways these creatures actually have a resemblance to the fictional mermaids. Being a mammal, the sea cow suckles its young. It has a single pair of breasts. Since it is also air breathing, the mother is obliged to raise its head and chest out of the water and to clasp the child in its arms in order that it may breathe while suckling.

Red Sea Mermaid

Although Columbus knew of mermaids through his own observations off the west coast of Africa, the first eye witness accounts came from the East, where another type of sea cow had long been observed. This creature, the dugong, lives in the Red Sea, along the shores of East Africa, the northern coast of Australia and the Indo-Malayan region. It is similar in most respects to the manatee, but somewhat smaller.

Tusks Spoil the Illusion

Whereas the manatee may reach a length of 12 feet, with a girth of over 7 feet, the dugong is usually about 8



THIS QUAINT DRAWING *shows how the natives of the Mabuiag Islands capture the dugong, an Indian Ocean and Australian relative of the manatee of the Atlantic. Harpooning is done from a platform. At the right a man is preparing to launch the* wap *or harpoon. To the left, the dugong has been harpooned and an additional rope is being secured to its tail. (After Haddon. From Yonge,* A Year on the Great Barrier Reef)

TO THE CHALDEANS *the fish god was Oannes, a male. This sculpture was found by M. Botta in the excavations made at Khorsabad, northern Iraq. (From S. Baring-Gould* Curious Myths of the Middle Ages *1897)*

feet long. The tail is also different. Instead of being rounded in outline it is crescent-shaped and thus more like a mermaid or fish tail, though flattened in a horizontal rather than vertical plane. On the other hand, the presence of a pair of 8-inch-long tusks, which project downwards from the upper jaw, can hardly be considered maidenly.

Development of the earlier seafaring civilizations undoubtedly helped to spread accounts of the dugong and manatee, and to perpetuate the mermaid legend. But the true origin seems to lie deeper. The half-man half-fish is a universal belief of mankind. The Chaldeans believed that a creature half-man and half-fish came out of the Erythrean Sea which bordered Babylonia and taught men how to build cities and other civilized arts. This is Oannes, called by the Philistines Dagon. Apparently Oannes was a sun god and his form symbolized the fact that he rose from the sea in the morning and re-entered at night.

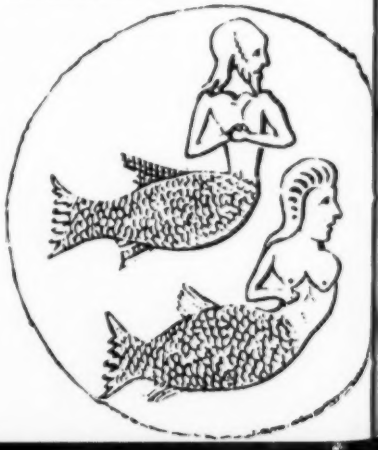
Union of Fish and Huma

The influence of Oannes, according to S. Baring-Gould, writing at the end of the last century, may be traced through the related Semitic moon goddess Atergatis, to the goddess Mylitta, and the name given to the priestesses of Demeter, which was Melissae. Baring-Gould further traces this name to Mélusine, which is the romantic mermaid of the Gallic fable.

Whatever the truth may be of the complicated history of these names there is no doubt that the union of fish and human was an old and very general ingredient of religious beliefs, perhaps because of the awe in which the wonders of marine life were held by the early fisherman, an awe which would be exaggerated still further when passed on to the landlubber.

Laplanders believed in the noble reincarnation of man in the salmon. A common Asiatic legend is that of the fisherman who frees a fish, which

THE ORIGINAL FISH GOD *of the Chaldeans eventually became a sun god, and acquired a companion sun goddess, possibly the first mythical mermaid. The pair shown here were copied from a seal in the British Museum, London. (From* Munter's Babylonier)



THERE IS A NEAT BIT OF BYPLAY *in this caricature of a droopy-eyed mermaid, combing her locks, and the walrus, one of the creatures often mistaken for mermaids. Seamen's reports of sighting mermaids are usually in direct proportion to length and loneliness of their voyages!* (Marine Engineer and Naval Architect *November, 1957*)

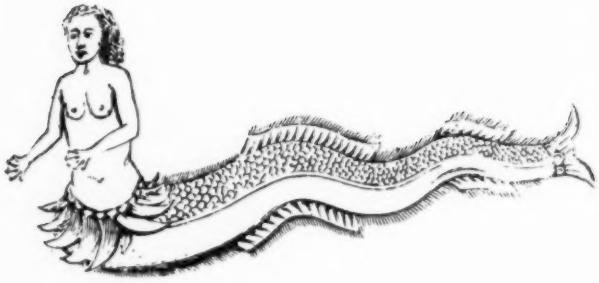
then turns out to be a god. The sea, in fact, was a great unknown and living thing, from which gods drew their powers.

Fish-god-of-our-flesh

The Eastern myths spread to the Mediterranean, where the Greeks invented a considerable variety of sirens, mermaids and tritons. It is rather probable that the northern European mermaids were derived from the Greek sirens rather than from the real dugong. Even so, the sailor who encountered a dugong would return home with a fine "true" mermaid story, which would bolster up the mermaid legend.

The Mexican sun or moon deity, Coxcox was a fish god, with the full name of *Huehueton-acateo-cateo-cipatli,* or Fish-god-of-our-flesh. The Peruvians had a fish god and the North American Indians believed that they were conducted from Northern Asia by a man-fish.

Interspersed with reports that were clearly based upon dugongs and man-



FANTASTIC IS THE WORD *to describe some of the creatures reported. This long-tailed mermaid, termed "the sea wyf," was pictured in full color in a book written by the Governor of Amboina, who claimed she was captured near the island of Boeren. (From S. Baring-Gould* Curious Myths of the Middle Ages, *1897)*

atees, the mermaid myth continued to flourish until the eighteenth century as the invention of printing provided wider scope for the inventors of such tall tales. In an Icelandic work of the 12th century the author informs us, "A monster is also seen near Greenland, which people call the Margygr. This creature appears like a woman as far down as her waist, with breast and bosom like a woman, long hands, and soft hair. . . . From the waist downwards this monster resembles a fish, with scales, tail, and fins."

Pontoppidan records a merman upon the shore of Denmark, attested to upon oath by several observers. Both Gesner and Hans Egede describe mermen. They also describe a bishop-fish and a monkfish with startling human appearance.

Mermaid Breaches the Dyke

In 1404 a mermaid was carried by storm through a breach in the dyke at Edam, Holland, according to one of the Dutch Colonial chaplains named Valentyn, writing in the 18th century. The mermaid was carried to Harlem and well taken care of. She learnt the useful art of spinning and died several years later, reportedly a Christian convert. It is not surprising, in view of Valentyn's unquestioning acceptance of this story, that he also describes the sighting of schools of mermen by Dutch soldiers on the beach at Amboyna, on at least two occasions in 1652.

The Governor of the Province of Amboyna and President of the Commissioners of Batavia provides an account of a mermaid in a book illustrated with hand-colored plates and published in 1717. "Sea-wyf. A monster resembling a Siren, caught near the island of Borni, or Boeren, in the department of Amboine. It was 59 inches long, and in proportion as an eel. It lived on land, in a vat full of water, during four days seven hours. From time to time it uttered little cries like those of a mouse. It would not eat . . ."

The accompanying colored illustration showed an olive colored body,

grey face, hair like seaweed, an orange fringe with blue border around the waist, green fins and a row of pink hairs along the tail.

Monkey with Fish Tail

Such stories as these became fewer in number as scientific knowledge replaced speculation, and as reports of the dugong and manatee became more widespread. Nevertheless, there was still, earlier in the twentieth century, a flourishing trade in fakes made by skillfully joining the torso of a monkey to the tail of a fish. These were made and exhibited in Oriental seaports and Japan and are still occasionally to be seen by the gullible traveller.

Are Mermaids Good to Eat?

The sea cow, which has encouraged and contributed to the mermaid myth, even if it did not originate it, is now well known to marine biologists. Altogether there are about eight species, some of which are only known as fossils, and one recently extinct. Both the manatee and the dugong, like land cows, are docile creatures and very good to eat. The Australian aborigines regularly harpoon them.

A BABY MANATEE *at The Marine Laboratory, University of Miami. The heavy bulbous upper lip, with white bristles, makes it difficult to reconcile the manatee with the mythical mermaid. But, seen from a distance at sea, with young at the breast, it might fit in better with the legendary idea. (Walter R. Courtenay, Jr.)*

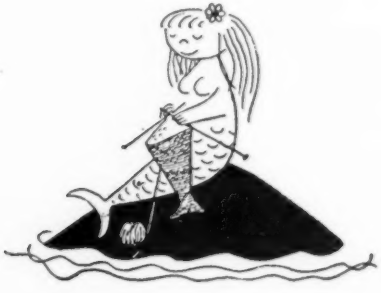
When a Russian expedition discovered Bering Island, in 1741, its crew was shipwrecked there and obliged to live for more than six months on the food they could catch from the sea. This consisted of a huge mammal, up to thirty feet long and 8,000 pounds in weight. Its fore end resembled a seal and the hind end a fish, but it had no dorsal fins.

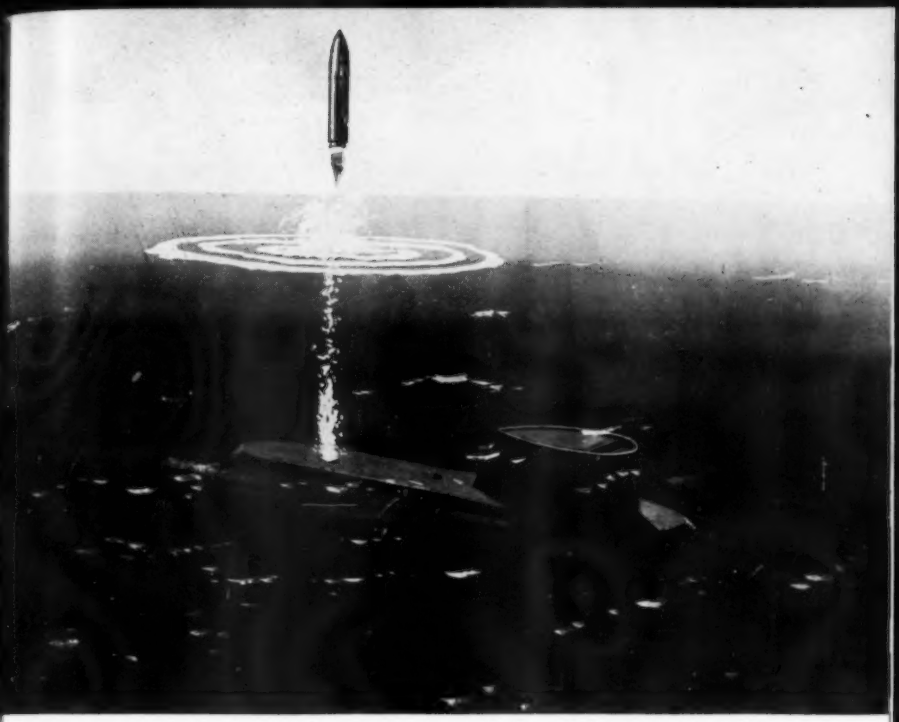
It was, in fact, a giant sea cow. According to George Wilhelm Steller, who became the expedition leader when Vitus Bering died, the meat of the calves resembles pork, that of the cows veal and the meat of old animals cannot be told from beef. Steller's sea cow, *Rhytina,* was last seen in 1854 and is now considered extinct.

As cities grow and flood control, docks and bulkheading encroach upon the natural habitat of the manatee, it is in danger of disappearing from the North American mainland. It is not too plentiful, even in such protected areas as the salt water lagoons of the Everglades National Park, in Florida. But before it does disappear, along with the mermaids, marine biologists at the Miami Marine Laboratory would like to find the answers to some half-solved questions.

First of all, the bones of manatees are dense and heavy, like ivory. This may well enable the creature to sink below the water surface with a lung full of air and so assist it in feeding. Long submergence and the energy requirements of a warm-blooded animal would be expected to increase the requirement of red blood corpuscles, which transport life-giving oxygen and food to the body tissues. Since the bone marrow, one of the places where blood cells are manufactured, is greatly reduced, the other organs in which these cells may be grown must have an unusual development.

It has been noted that the muscles and body of the manatee generally are heavily loaded with blood pigments so that the meat looks dark. This is undoubtedly a device for increasing the oxygen-carrying capacity of the animal and therefore its ability to submerge for long intervals. A similar mechanism is found in whales. Perhaps the complete answer will be found before the manatee, like the mermaid, disappears.





IS THIS THE ULTIMATE *in surprise attack weapons? An artist's conception of the U. S. Navy's new class of guided missile submarine, capable of firing a "Polaris" rocket while stationed beneath the surface. This nuclear-powered craft, now under construction, will be equipped with the latest sonar and other listening devices, as well as torpedo tubes to make it effective against enemy submarines and surface ships. However, more mapping of the ocean's bottom, as well as additional research on the currents and temperatures of the depths, will have to be undertaken before such vessels can operate with safety and efficiency. (U.S. Navy Sketch)*

Oceanography and National Defense

By E. JOHN LONG

WITHIN THE next few months, and possibly for some time to come, three initials—A.S.W.—will crop up with increasing frequency in technical and scientific journals, and in the press, TV, and radio as well.

A.S.W. stand for "Anti-Submarine Warfare," a vital and most intricate type of military operations which has only recently assumed great strategic importance and top development priorities throughout the free world. While the general public may be vaguely aware of it, Anti-Submarine Warfare remains a mystery to almost everyone outside the military services and oceanic sciences.

Yet, lack of knowledge of A.S.W.

is not the result of any heavy veil of secrecy drawn over it by the censors. Most of its basic principles and operational methods are known throughout the maritime world, on both sides of the Iron Curtain. As a matter of fact, the U. S. Navy has listed in some detail the technical problems and shortcomings of A.S.W., as we practice it today, in the hope that a civilian scientist or technician or inventor may come up with answers which will make it more effective.

What are some of these problems? Actually they are less military secrets than fundamental mysteries of the sea itself. While there are several ways of detecting the approach of aircraft and of surface ships—radar, sight, sound, etc.—only two effective methods have yet been found for discovering the presence of fast-moving submarines, running deep. Both of these use sound, one with the echoing ping of sonar, the other with noises made by the submarines themselves.

Beware of the Thermocline!

But sound in water is even more eccentric than it is in the air, where sound waves may bounce over broad areas to be heard far beyond. Where warm and cold currents in the sea intermingle, listening devices run into all kinds of trouble. Thermoclines, or sharp differences in water temperatures, refract or divert the sonar's ping, and provide ideal haven areas for prowling submarines. And, most unfortunately for the United States, some of the best (or worst?) thermoclines are most likely to be found along the edges of the Gulf Stream, a comparatively short distance offshore and within easy rocket-bombing range of most of the major cities and heavily populated parts of the eastern seaboard.

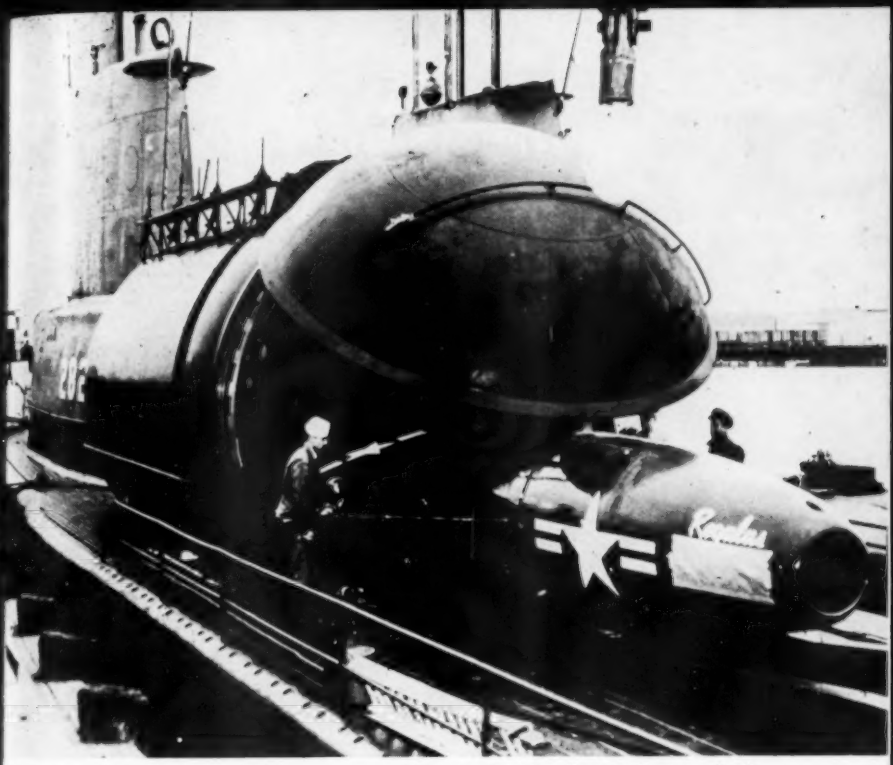
We all may as well face up to the fact that enemy submarines are not solely the Navy's concern. Not a single square inch of the U. S. is more than 1,500 miles from submarineable waters — and 1,500 miles is merely medium range for some of today's most accurate missiles. So the submarine has become every bit as grave a threat to our security as the enemy airplane, and probably more so, when its more stealthy approach is considered, with only minutes' early warning.

Other Obstacles

Even if scientists were able to overcome such interfering factors as thermoclines, however, other obstacles stand in the way of a dependable device to pin-point enemy submarines. After "detection" of a mysterious sound by listening devices or by sonar echo comes another big problem: "classification."

Sub hunters, or "goblin killers" in Navy vernacular, must somehow figure out whether the object is a whale, a school of fish, a bottom pinnacle, a sunken wreck, a figment of the imagination, or really a submarine.

"The ocean," according to Rear Admiral John Smith Thach, commander of the A.S.W.'s Task Group Alfa, "is a liquid jungle. Survival depends upon how well we know this environment and whether, like Tarzan, we can tell the friendly sounds



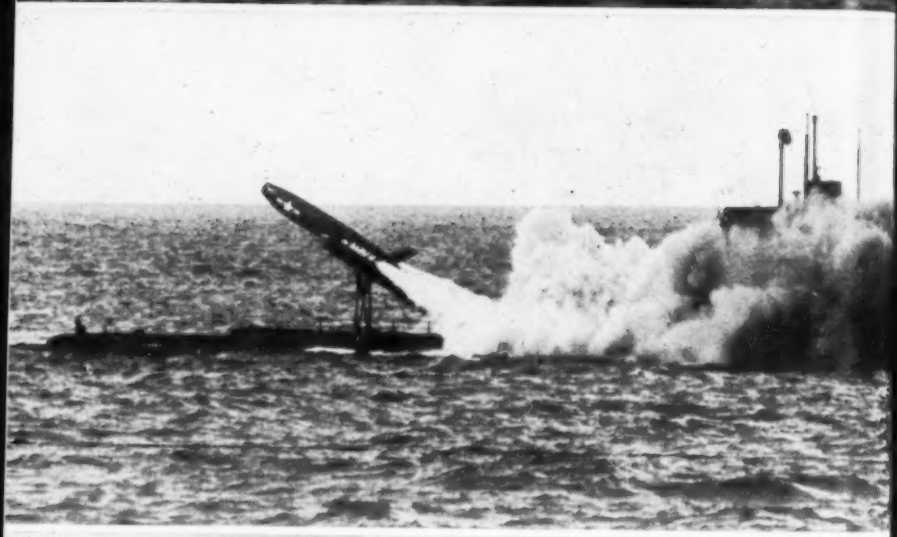
HOW A SUBMARINE *can hide away a guided missile. We do not know whether Russia has a weapon similar to the Regulus, the U. S. Navy's surface-to-surface guided missile, but it is reasonable to assume the Soviets have kept pace with the free world in such matters. No part of the United States is more than 1,500 miles from waters in which enemy submarines could launch such weapons—and 1,500 miles is merely medium range for some of today's most accurate nuclear missiles. (U. S. Navy Photo)*

from the unfriendly ones—the monkeys from the tigers."

While fiction writers talk of the "silent depths of the sea," oceanic waters seem very noisy to the man listening to an underwater microphone. This cacophony of the depths ranges from the crackling of a school of shrimp, and the cluck of the sea robin, to the sizzling noises of eels. A white whale may creak like the rusty lid on Davey Jones's Locker, and most frustrating of all are the jocular sounds made by the porpoises—a school of them is bedlam.

Few realize what a versatile boat (the proper term for submarines) a submarine can be. She can operate as a man-of-war, a commerce raider, a mine layer, a planter of spies and saboteurs on lonely beaches, an evacuator of refugees, or, her newest role, as a missile launcher.

But, like any other vessel, a submersible must still have some reasonably accurate method of navigation.



THREE S
f, the
guided
marine
(top), t
of carry
streakin
the hor
place fr
erations
Navy P

Underwater this presents considerable difficulties, many of them not faced by surface skippers. The submarine navigator must not only have some knowledge of ocean currents and counter currents, but also bottom topography, magnetic and gravitational fields, and a host of other phenomena of the depths.

Radioactive Markers

Senator Humphries, of Minnesota, told the U. S. Senate in February, 1959, that radioactive markers had recently been discovered off our coasts, and they were presumably planted by Soviet submarines for guidance in underwater navigation near the major Atlantic coast cities of the United States.

Russia's All-Out Effort

Victory or defeat in future wars may well hinge upon superior knowledge of the sea gained by scientists—especially knowledge of the ocean floor and its eerie life and environment — which accounts for Russia's present all-out effort in oceanography, involving world-wide operation of the largest and best equipped oceanic laboratory ships.

The Soviets, too, are fully aware that, while the seas cover 70% of the earth's surface, less than a third of the ocean floor has been mapped with any degree of reliability. Powerful underseas rivers, often running counter to surface currents, such as the recently-discovered one beneath the Gulf Stream, must be charted before the new and hardier submarines now coming into service can navigate with safety and accuracy. Russia is conducting this oceanic research as a civilian program, but it, of course, has military overtones.

Biggest Sub Fleet

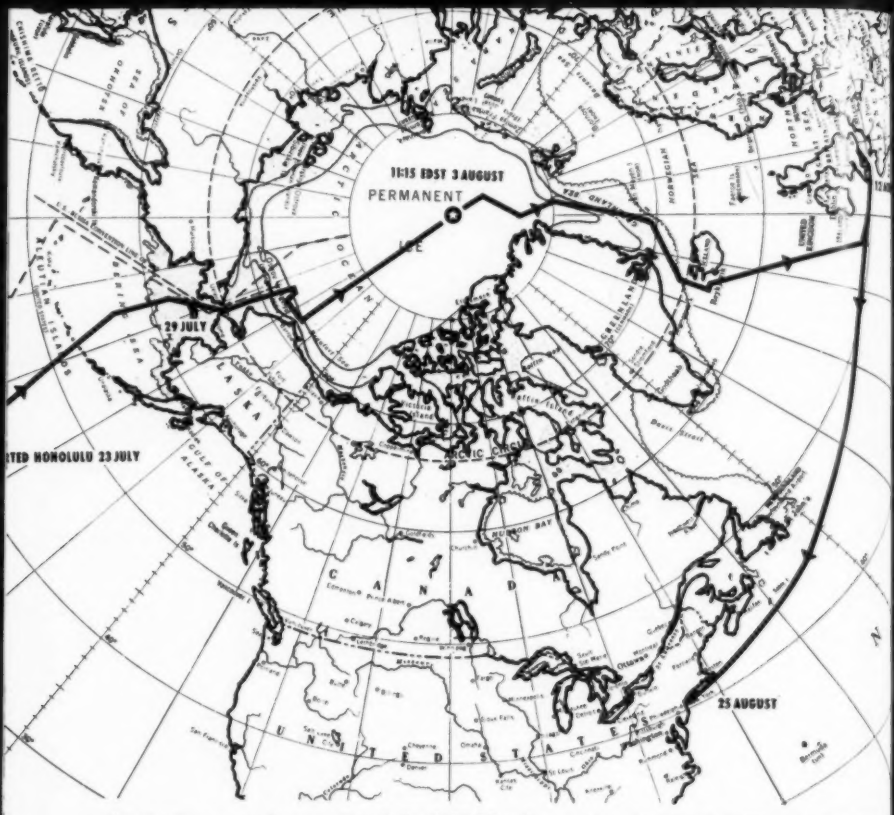
Which explains, in part, why the free world has stepped up enormously its Anti-Submarine Warfare program. Another most cogent reason is that the Russians, perhaps while trying to distract our attention with sputniks and outer space vehicles, have quietly built up the world's *largest* submarine fleet. Current estimates of Soviet submarine strength run from 450 to 500 ships. Most of them are new, and they are fast. Snorkels, the German device for charging batteries while submerged, are standard equipment. Nuclear propulsion, if they do not yet have it, is a matter of time.

Because of the fantastic abilities of the modern atom-powered submersible, such as the *USS Nautilus,* both submarine and anti-submarine tactics must be completely rewritten. As Rear Admiral H. G. Rickover recently put it: "The *Nautilus* marked the beginning of a technological revolution at sea."

True Submersible

The implications of this remark are enormous. What most of us do not

THREE STAGES IN THE FIRING *of Regulus I, the U. S. Navy's surface-to-surface guided missile. In minutes after a submarine has emerged from the depths (top), this unmanned weapon, capable of carrying an atomic warhead, can be streaking toward inland cities beyond the horizon (bottom). This test took place from the* USS Tunny, *during operations in the Central Pacific. (U. S. Navy Photo)*



IN MANY WAYS, *the voyage of the USS* Nautilus *under the North Pole was an even more significant event than the launching of the first "Sputnik." It proved that nuclear submarines could operate in any part of the world, including the polar regions, where they might launch missiles fairly secure from counter attack. The map shows the route taken during the epic journey, which began in Hawaii, July 28, 1958, and ended at New York, August 25, 1958. (U. S. Navy Map)*

realize is that, while we have been talking about "submarines" and experimenting with "submarines" for more than forty years, what we really have been discussing is a *surface* vessel which could submerge *temporarily*. Submerging was actually a necessary evil, used only when absolutely necessary to make a sneak attack upon the vessels of an enemy, or to escape.

Then came the famous German snorkel of World War II. With only the tip end of a thick stovepipe exposed, the U-boat could stay beneath the surface of the sea, and use its diesel engines almost indefinitely. But even a snorkel may become a tiny "pip" on a radar screen, and thus expose its source to air or surface attack.

Now, with the advent of nuclear propulsion and of revolutionary new hulls, such as that on the *USS Albacore,* we suddenly have a ship that

may really stay under water. Instead of a surface vessel which can *submerge* only temporarily, here is a vessel that has to *surface* only temporarily—long enough, according to one wit, for the crew to re-enlist.

Dive to Remarkable Depths

The newest American submarines, for instance, no more resemble those of World Wars I and II than the latest streamlined automobiles resemble the Model T. Much stronger and tougher, they can dive to remarkable depths and withstand persistent depth bomb attacks.

Most of the operational characteristics of nuclear subs necessarily are classified, or secret. But it has been announced that their official underwater speed is "over 20 knots" or about 23 land miles an hour, a truly remarkable performance in so dense a medium. And they are so easy to handle that their movements must be phrased in aviation jargon, such as "she flies," "ascends to a ceiling," and "banks at 30 degrees." Crewmen must sometimes hang onto straps like subway riders when the *USS Skipjack* "takes sharp heels and angles."

Hold Speed Almost Indefinitely

Unlike all previous types of submarines, nuclear craft can hold their top speeds almost indefinitely, whether submerged or on the surface. Range, too, is practically unlimited. Endurance, except for the human kind, is restricted only to the contents of the oxygen tanks. With an operating limit of 62,000 miles on one core of fissionable material, an atom-powered submarine can prowl over the seas of the entire world without returning to base for fuel.

Perhaps it appears from the foregoing that all the advantages in submarine warfare are with the aggressor. This is not necessarily true. Once certain that an enemy submarine has been spotted in war time, a number of A.S.W. devices can be brought into action. In addition to the old and reliable depth bomb, the U. S. Navy has recently developed two new lightweight torpedoes, designed to seek out their targets by following sounds.

Known as the Mark 32 and Mark 43, they are first of a series developed by the Navy in its stepped-up concentration on anti-sub warfare. Mark 43 may be launched from either surface ships or aircraft. Mark 32 is designed for ship launching only.

Submersible Guided Missile

Rear Admiral F. S. Withington,

ON NUCLEAR SUBMARINES *a constant check for possible radiation activity is made. Here a medical officer on board the USS* Nautilus *makes a notation in his log book, after measuring radiation of a dried water sample in the nucleonic laboratory of the vessel. (U. S. Navy Photo)*

chief of the Bureau of Ordance of the United States Navy, terms the Mark 42 "actually a submersible guided missile capable of searching to great depths for enemy targets." It is propelled by an electric motor, powered by a battery.

Mark 32 is probably the simplest anti-submarine weapon yet developed. It can even be tossed overboard from an open launcher. As soon as the torpedo hits the water its built-in power plant and acoustical homing devices take over, and carry it at high speed to its target.

Sonobuoys and M.A.D.

Another important A.S.W. vehicle is the helicopter. From carriers these versatile craft can fly out to areas where a submarine contact has been noted by a surface ship. Hovering overhead, the helicopter pilot can lower a sonar dome into the water and listen for the echoes that fix the location of whatever is below.

Helicopters have been found useful, too, in a kind of "triple play" A.S.W. defense-attack. Should an enemy sub surface as long as fifteen minutes to fire a missile, it would most certainly be picked up by radar, usually on a surface ship. Within a matter of minutes, Act Two would unfold—a plane (S2F), catapulted from a carrier, arrives at the datum point or scene. Smoke flares would be dropped, and also sonobuoys (floating devices send-

E VERSATILE HELICOPTER *also plays a e in anti-submarine warfare. After an emy submarine contact is established, licopters take off from carriers or er Navy ships. Lowering sonar gear o the water from a cable, they can pinpoint the location of the submerged ft. An acoustic torpedo, dropped m another helicopter or a surface ip, would make the kill. (U. S. Navy oto)*

ing out sound waves in the water and transmitting reports of them by automatic radio).

The planes would also use their magnetic detection gear (M. A. D.), which spots magnetic objects under water.

Act Three would be the appearance of helicopters, hovering over their lowered sonar gear, and hunting in circular pattern. Contact made, an acoustic torpedo, dropped from a second helicopter, would make the kill.

Hope for Lucky Contact

But suppose the submarine-fired missile was similar to our "polaris," which can be launched from beneath the surface of the water? We do not know for sure whether Russia has a missile similar to "polaris," but it is fairly safe to assume that the Soviets have at least kept pace with improvements made in free world submersibles. In which case, A.S.W. forces must rely upon the chance that one of our surface ships will be lucky enough to be near enough to pick up the submarine on its sonar or sound gear.

Actually the primary mission of each ship in the Allied navies is A.S.W. "Everything else is secondary," according to Admiral Jerauld Wright, commander of the Atlantic Fleet. About 61% of the U. S. Navy's budget now goes, directly or indirectly, into A.S.W.

Task Group Alfa, presently assigned to special A.S.W. work, includes the aircraft carrier *Valley Forge,* eight destroyers, a squadron of carrier-based Grumman S2F sub-hunting aircraft, a helicopter squadron, a land-based patrol squadron of P2Vs, several blimps, 5,000 men, and a network of electronic eyes and ears.

Alfa operates on a 24-hour-a-day basis out of Norfolk, Virginia, where an underground anti-sub plotting room keeps tab of every unidentified contact made in 100,000 square miles of open ocean. That its crewmen are kept busy is indicated by Alfa's log for the last six months of 1957—186 reports of what might have been Soviet subs.

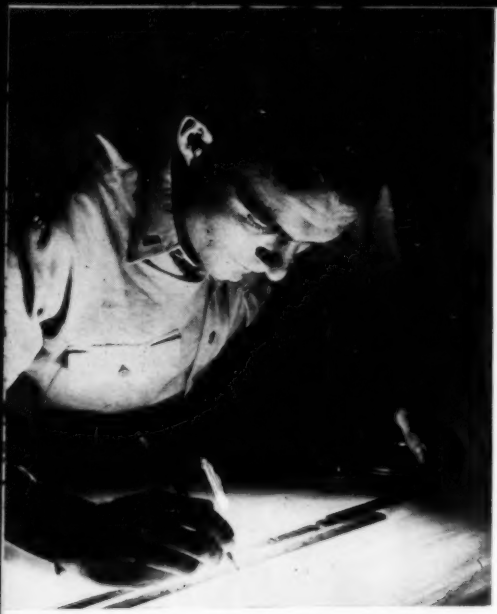
Far East Springboard

Of course the United States is not the only country vulnerable to submarine attack. Japan is very close to the Soviet Far East submarine stronghold of Vladivostok, which would also be the springboard for any Russian sub movements against Canada, western United States or Latin America.

Russian super-submarines, with apparatus capable of hurling nuclear missiles, have twice been sighted on sea patrols in the Far East, and a third was seen operating in the Atlantic.

Navy's Responsibility

While it must be quite obvious that the defense forces of the Free World have an increasing need for the services and skills of oceanographers, the



THE NAVIGATION OFFICER *of the destroyer USS* Ozborn *plots the course of his ship during anti-submarine exercises of the U. S. Navy in Pacific waters. Reports are received from air, surface and underwater units of suspected "enemy" submarine movements, and a coordinated "attack" is then launched. (U. S. Navy Photo)*

question arises "What is the military doing to aid and abet oceanographic work?" The record, past, present and future, shows "Quite a bit."

In 1946 a Division of Oceanography was established by the U. S. Navy Hydrographic Office, and a year later the Office of Naval Research lauched a program in Oceanography which has been expanded to the point that nearly all oceanographic laboratories or institutes are sponsored to some extent.

The TENOC Program

At present there are from 500 to 800 qualified oceanographers in the United States. Thirty to fifty per cent of their time is spent underway in slow, small ships. However, these sailor-scientists have made such major contributions to underseas work as towed-sonar and the bathythermograph, the latter an instrument which proved very useful to submarines in diving and evasive tactics.

"Present demands on our oceanographers' services have overcommitted their time by a factor of three," Rear Admiral John T. Hayward, assistant chief of Naval Operations for Research and Development, recently told a Congressional sub-committee on Oceanography. "Until we can increase their numbers we cannot expand our oceanography program.

"TENOC (ten years of oceanography) is a well conceived plan of attaining this increase in seagoing scientists. The Chief of Naval Operations, Admiral Arleigh Burke, has endorsed this as the oceanography portion of the Navy's Research and Development, Shipbuilding and Military Construction Programs."

Calls for 18 Research Ships

In brief, the TENOC Program calls for a total of 18 oceanographic research ships to be built between 1960-68. Compared to the big Russian oceanographic ships already in operation, such as *Vityaz, Mikhail Lomonosov,* and *Ob,* these ships will be small, but they will have a trial speed of 13 knots. The smaller size is preferable to U. S. scientists since it entails a much lower operating cost. Under the TENOC program each oceanographic institution must meet its own expenses.

ONE OF NATURE'S MOST REMARKABLE SPECTACLES *is the "nightgown weaving" parrot fish. Certain members of the family Scaridae at night envelop themselves in a mucous covering that blends into the background of their reef homes. Next morning they shed the covering and lead their normal lives. (American Museum of Natural History, from Smithsonian Institution)*

Fish That Wear "Nightgowns!"

THERE ARE FISH that wear "nightgowns!" In the daytime they are among the most colorful of all sea creatures, but at night they envelop themselves in a mucous covering that blends into the background of their rock and reef homes, possibly to escape the notice of midnight predators.

These are species of parrot fishes, a family (Scaridae) widely-distributed through tropical waters, particularly near coral reefs. A systematic review of the entire group by Dr. Leonard P. Schultz, U. S. National Museum curator of fishes, has recently been published by the Smithsonian Institution.

Widespread Phenomenon

This strange practice of donning night robes was observed in the West Indies by Dr. Howard E. Winn, of the University of Maryland. It was seen also by Dr. John E. Randall, ichthyologist of the Miami Marine Laboratory, in Hawaii and Tahiti.

As night approches these fish cease their normal swimming and feeding habits, and rest along the shallow sea bottom. They lean against rocks, arms of coral, or other stable objects. Sometimes they retire into large empty conch shells.

Meanwhile they start to secrete a transparent mucous envelope from a special secretory system. It starts with the mouth and is extended backward, until the transparent envelope encloses the body as completely as do those new plastic "garages," used to protect cars parked in the open along the seashore.

Flaps in Front and Rear

There is a little flap with a hole in the center in front of the parrot fish's open mouth. There is another hole at the rear. The mouth flap moves back and forth as the animal breathes. The openings assure a constant flow of water around the gills, without which the animal could not live.

The entire process of nightgown-making requires from a half hour to an hour-and-a-half. It stops entirely, Dr. Winn observed, whenever light was turned on in the aquarium, but resumed immediately with darkness. As the folds progress the breathing rate is reduced.

True Purpose Unknown

The true purpose of wearing nightgowns can only be surmised. The thin garment, he believes, may afford some sort of protection against nocturnal enemies. Also it may protect the body from becoming surrounded by silt.

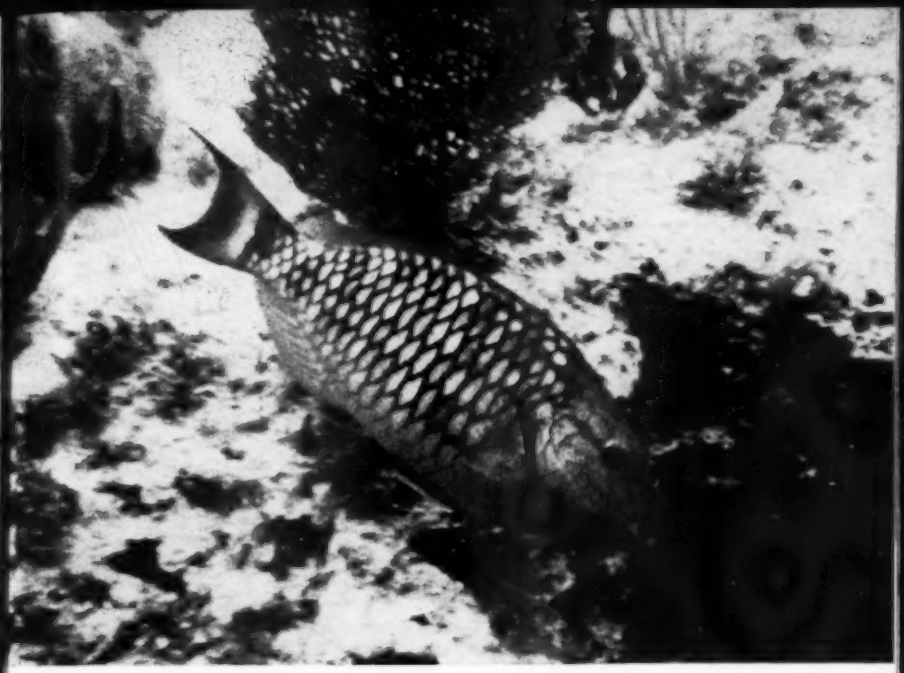
LIKE A COW NIBBLING *in a field, the pa rot fish grazes on the fleshy a ae th grow on the stone and coral fo mation of the sea bottom. The parrot i one the few fishes that masticates its foo first scraping off the algae with its sha dental plates, and then grindin a pulverizing the algae and any stray bi of coral with a second set of teeth the back of its throat. This non-nigh gown-weaving or red parrot fish is show feeding on the reefs off the Exumas, the Bahamas. (Photo from John E. Ra dall)*

The gown-weaving, as well as the practice of spending the night leaning against some solid object, apparently is dictated by some nervous mechanism which is set off by darkness. So far as known, the practice is unique in nature.

Bright Males, Drab Females

But this is only one of the parrot fish's curiosities. Colors, of males, become more and more brilliant as adulthood is approached, and a fully matured individual of some species is one of the handsomest denizens of the deep. Females of some species, however, may remain throughout life rather drab individuals.

"Many species," Dr. Schultz reports, "pass through from one to three color phases. In general these are juveniles, in which the color may consist of two or three alternating dark and light streaks, or spots that are dark or mottled pale and dark; immature, in which the color pattern is usually some shade of red, brown, or purple; and adult, in which the color pattern seems to be reached somewhat before or at sexual maturi-



ty, with the predominating colors generally green, blue, pink, red, orange, and yellow. A few species are brownish. Some of these are females, but the males predominate in shades of green or blue and with green teeth."

Teeth in the Throat

Color changes, it is explained, are a factor which makes species classification quite difficult. Living in the shelter of coral banks and quite secretive in their ways of life, these parrot fishes, or Scaridae, have remained among the least known of fish groups.

Their food, for the most part, consists of algae, which are scraped from the coral branches. This necessitates the so-called pharyngeal mill, or teeth in the throat, designed to crush coralline algae, coral fragments, and other food items. The upper pharyngeal teeth are paired and fit snugly against the base of the skull. The number of rows on each upper pharyngeal bone varies from one to three, according to genera.

Shoulder Girdle Muscles

The lower pharyngeals consist of a single bone with a toothed surface. This arrangement constitutes a grinding mill operated by powerful muscles attached to the shoulder girdle and base of the skull.

Some species apparently have a very wide distribution, while others are more restricted in range. More collecting in numerous island groups will be required before the distribution of individual species can be determined.

FIRST AND OLDEST WOODS HOLE *oceanic institution, the Station of the U.S. Fish and Wildlife Service, Bureau of Commercial Fisheries, as it appeared in November, 1957, before demolition work began, preparatory to erecting new buildings. Several times laboratory and administration buildings were damaged by hurricanes and severe winter storms, but, during the past three-quarters of a century, the Station has conducted a notable series of experiments in marine biology and fisheries research. (U. S. Fish and Wildlife Service)*

New for Old

By PAUL S. GALTSOFF

"IS THERE ANYTHING we can see here?" "Where are the marine exhibits?" All through two summer months one can hardly walk a block along Water Street in Woods Hole, Massachusetts, without being stopped by a visitor and asked these questions.

The American public has become more sea conscious. Its curiosity and interest have been aroused by a number of popular books about life in the sea, by excellently illustrated articles in magazines, and by scores of pamphlets and technical papers issued by the Woods Hole Oceanographic Institution and the Marine Biological Laboratory, describing the facilities and the new horizons opened up by scientific research conducted within their walls and aboard ships.

"No Exhibits" Signs

Unfortunately, at present the natural curiosity of an intelligent visitor remains unsatisfied. He sees large brick and glass buildings, a number of old barrack-like structures, and crowds of students and scientists dashing back and forth from one building to another, but he is politely reminded by signs, prominently displayed at the entrances, that there are "no exhibits in this building."

The first and the oldest Woods

Hole institution, the U. S. Fishery Biological Station, is temporarily closed. No longer can it welcome the American tourist with a display of local fish, shellfish, and other exhibits. After nearly three-quarters of a century of work, interrupted only by World Wars I and II, the old station, damaged by a succession of tropical hurricanes and storms, was demolished November, 1957, but is now being replaced by a new structure suitable for the needs of modern research.

New Station Rising

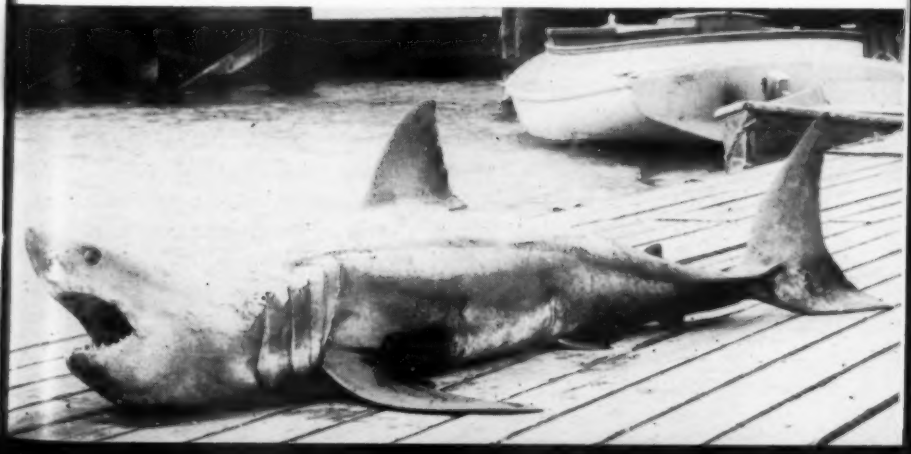
The visitor to Woods Hole can see the framework of the three-story building, 190′ by 40′, divided into fifty rooms to be constructed of steel, ceramic tile, and glass. The new station will have ichthyological, biological, physiological, microbiological, malacological, chemical, and electronic laboratories, as well as a large number of tanks and tables supplied with tempered sea water, library, drafting shop rooms equipped for mathematical computations, conference hall, and offices.

The aims of its present scientific research in fisheries remain the same as they were in 1871 when the passage of a joint resolution of Congress instituted the U. S. Fish Commission, predecessor of the present Bureau of Commercial Fisheries. Although the name of the organization has been changed several times, its function remains the same, namely, "to investigate the condition of the fisheries in respect to their alleged depletion, the causes which may have led to their impoverishment and the means by which they might be conserved and their productiveness increased."

Why Locate Here?

Spencer Baird, the first Commissioner of Fisheries and the founder of Woods Hole as a center of marine research in the country, gave the following reasons for his choice of Woods Hole as the site of a permanent laboratory:

ONE OF THE UNUSUAL CATCHES *brought to the Fisheries Biological Station dock was a sharp-nosed mackerel shark, which greatly resembles its cousins, the mako shark and the white shark. (U. S. Fish and Wildlife Service)*



AND THE WALLS CAME *tumbling down. Making way for more modern structures, suitable for the needs of today's fisheries research, the old administration building falls before the demolition crews, November, 1957. (U. S. Fish and Wildlife Service)*

"The water (at Woods Hole) is exceptionally pure and free from sediments—the entire absence of sewage owing to remoteness of large towns, as well as the absence of large rivers tending to reduce the salinity of the water, constitutes a strong argument in its favor."

Seventy-eight years later some of this appraisal of Woods Hole sea water still holds true, namely, its constant salinity which greatly contributes to the success of biological research. As to the absence of pollution, the situation has drastically changed. Large signs, posted by the local shellfish warden and displayed along Water Street of Woods Hole, caution prospective fishermen and tourists that taking of shellfish from local waters is prohibited because of the pollution.

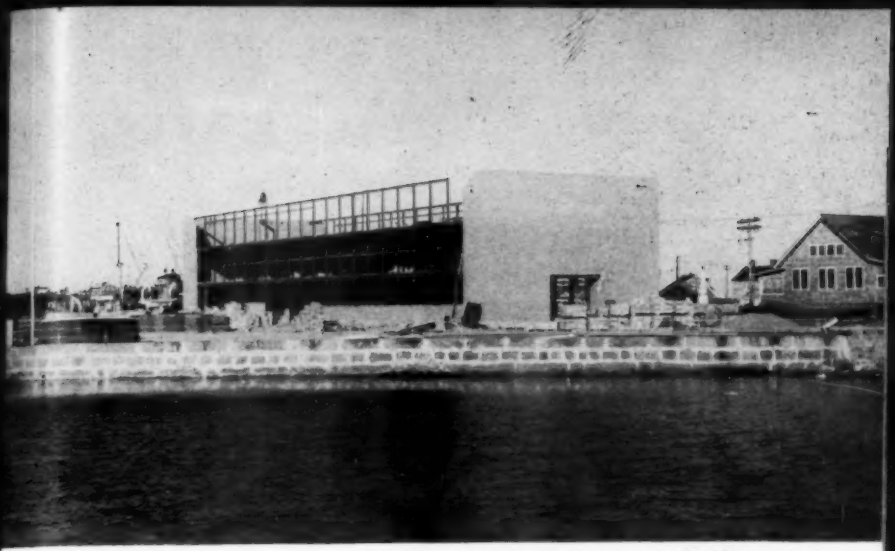
Unfortunate Situation

The growth of population, influx of thousands of tourists, many pleasure boats, but, primarily, unwillingness of local authorities to institute an adequate sewage disposal system are responsible for the present unfortunate situation, brought about by our ignorance, negligence, and disregard of conservation.

In conducting its present research the U. S. Fisheries Laboratory follows the general program formulated long ago by Spencer Baird. It seeks to find practical and efficient ways to manage and develop our oceanic and inshore fisheries.

Unanswered Questions

Many puzzling questions remain unanswered: what causes wide fluctuations in fish stocks; why some of the formerly abundant species, for instance, cod and mackerel, recently



NEW FISHERIES LABORATORY *building as it looked early in 1959. In addition, there will also be a modern aquarium, open to the public during the summer months, which will contain twenty-five display tanks of various sizes. Exhibits will show the most important marine species in a natural habitat, and demonstrate the value of living resources of the ocean. (U. S. Fish and Wildlife Service)*

became scarce; is it possible to foresee for each year the time and the location of large schools of fish as they appear over the continental plateau; and how various fisheries should be regulated in order to maintain the greatest yield without depleting the stock.

These are difficult questions to answer. The life in the sea is very complex. It is affected by changes in temperature and currents, the presence of specific food, the diseases which may wipe out the entire population of commercially important species, and the effectiveness of predators, including man with his ever-improving fishing gear.

Marine biologists realize that answers to these basic questions cannot be found by studying one particular species of fish or shellfish. Life in the ocean must be investigated in all its complexity and interrelations.

The new laboratory will offer adequate facilities necessary for the studies of these important problems.

New Aquarium

A vital part of the new laboratory will be a new aquarium, with various auxiliary facilities and shops, the design of which has been completed. The aquarium will contain twenty-five display tanks of various sizes ranging from 3′ x 5′ x 3′ to 20′ x 5′ x 4′. Some of these tanks will be supplied with recirculated sea water, the temperature of which may be maintained throughout the year at any degree from 35° to 72° F.

Many of the tanks are of sufficient dimensions to permit an experimental

TYPICAL OF THE SEVERE STORMS *that sometimes rake the Cape Cod area of Massachusetts is this northeaster, which pounded the buildings of the U. S. Fisheries Biological Station and the waterfront at Woods Hole, in November, 1947. Occasionally these big blows sweep in a few "dividends," such as seaweed and other marine life scoured from the bottom by the waves. (U. S. Fish and Wildlife Service)*

study of the behavior of fish, schooling, reactions to light or sound, orientation with regard to magnetic field, and similar problems.

Open to Public in Summer

During the summer months the aquarium will be open to the public. Its exhibits will intend to show the most important marine species in their natural habitat, to demonstrate the great value of the living resources of the ocean and the necessity of their conservation and management. There will be no circus-like exhibits of trained seals, dolphins, and birds, since the primary purpose of the station is scientific research and education in conservation.

The present building program is scheduled to be completed in 1960, when the staff of the Bureau of Commercial Fisheries will return from its temporary quarters, two miles from Woods Hole, and again will be able to welcome the visitors to Woods Hole who want to satisfy their natural curiosity and learn more about the life in the sea.

Florida Tarpon Swims to Louisiana

News of the finding of the first of 185 large tarpon, tagged at Boca Grande, West Florida, in the summer of 1958, has reached The Marine Laboratory, University of Miami. Ernest M. Loëb, III, of New Orleans, discovered the remains of a tarpon bearing a yellow plastic spaghetti tag of The Marine Laboratory in Bayou St. Milo, St. Bernard Parish, Louisiana, on December 6, 1959.

Mr. Loëb stated that the hull of a high speed outboard motor boat was damaged by running over a large fish in the same area a week before he found the tarpon. He thought it likely that the tagged tarpon was the fish which was struck by the boat.

Tag Number Needed, Too

The tarpon was in a state of decomposition, so Mr. Loëb lingered only long enough to read the tag inscription. Unfortunately, he overlooked the tag number stamped in the monel clamp of the tag. It is hoped that data from future recoveries will include the tag number (or better still, the tag itself), the precise length of the fish, and several scales.

If not too distant from Miami, it would be greatly appreciated if a tagged tarpon were placed on ice and the laboratory contacted by phone or telegram so that a member of the staff can come to examine the fish. Valuable information on age and growth of tarpon will be the result.

Only Third Recaptured

The Louisiana tarpon is only the third large tagged tarpon that has ever been recaptured. The other two, one tagged in July, 1938, and found 72 days later in the Myakka River 19 miles from Boca Grande, and the second taken 10 miles south in Captiva Pass, were suggestive of more limited movement.

The recovery in Louisiana has demonstrated that tarpon can move long distances. Previously, long migration could only be surmised from the observation of offshore schools of tarpon moving directionally and by catching strays as far north as Nova Scotia, where it is improbable that they could survive all year.

New "Seacoasts" and "Seaports" Inland!

Although the St. Lawrence Seaway, the most ambitious construction job since the Panama Canal, is an inland waterway, it makes 8,300 miles of coast—a stretch longer than the whole U. S. Atlantic seaboard—accessible to large ocean vessels. For deep-water ships out of Liverpool and Hamburg, completion of the Seaway means that Cleveland is suddenly closer than Baltimore; Chicago, Milwaukee, Detroit, and Duluth are, except in mid-winter months, as handy to Europe as Miami and New Orleans.

The Sea Serpent that is a Fish

By VLADIMIR WALTERS
American Museum of Natural History
New York, N.Y.

THE OARFISH *(Regalecus glesne)* is a seldom-seen inhabitant of the dimly-lit depths of the open sea. Its large size, bizarre coloration, and striking appearance engender strange roles for the creature in the minds of almost all who behold it.

Because it is said to accompany or announce the beginning of the herring run, to northern Europeans it is the "king-of-the-herring." Oddly enough, Indians of the northwest Pacific coast hold a similar belief with regard to a relative of the oarfish, called "king-of-the-salmon" (*Trachipterus rex-salmonorum*). The "king" appears just before the salmon run, and to kill it, say the Indians, means the salmon run will cease.

Blades on Fin Tips

The name oarfish derives from the unusual pelvic fins. These are long and slender, with a blade-like expansion at their tips, thus resembling a pair of oars. The Japanese, however, call the fish "cock-of-the-palace-under-the-sea," in allusion to the crest of long dorsal fin rays atop the head. These number up to eighteen in a large individual and can be raised and lowered like a rooster's comb.

The nickname "sea serpent" comes from the elongate body (a ten-foot fish may be only five inches deep), the eel-like method of swimming, the enormous size of some individuals (35 to 40 feet in a complete fish; a 56-foot "sea serpent" found at Orkney, in 1808, was probably an oarfish), and the flame-red dorsal fin that looks like a fiery mane. Quite a few reports of sea serpents can doubtless be attributed to sightings of the oarfish.

Washed Ashore in Florida

On May 12, 1958, an oarfish was chased ashore by a shark at Pompano Beach, Florida. Its body had been almost completely cut into three pieces. The pieces were taken to the taxidermy studios of Joseph Reese at Fort Lauderdale, and there placed under refrigeration until a biologist could examine them. Thus the first adult oarfish from Atlantic coastal waters of North America became available for scientific study.

The remains turned out to be those of a male, which is of interest since most oarfish that have been examined were females. Had the Pompano Beach fish not been injured earlier in life it would probably have measured ten feet in length. However, almost all captured oarfishes, other than very young ones, lack up to half their bodies, but show signs of healing and regeneration of their old injuries.

The Pompano Beach specimen, which measured just less than five feet in length, for example, shows a nicely-healed tail. Apparently the oarfish can

survive a loss of about half its body to a predator, although, since the stomach occupies almost half the length of the tail, any greater loss would probably prove fatal.

Too Sly For Nets

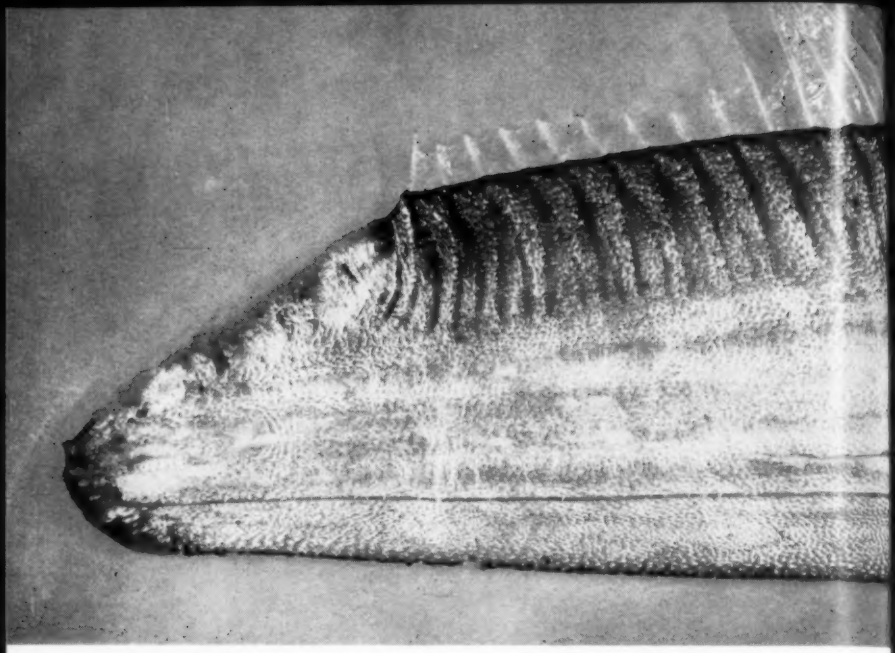
Very little is known of the life history and habits of the oarfish. The eggs, which are about the size of air gun pellets, drift in the open sea for some three weeks before the quarter-inch larva is hatched. It is surmised that, owing to its well-developed eyes, brilliant red fins, silvery body and blue-black polka dots and slashes, and the great reduction in the amount of bone in the skeleton, the adult lives at depths from 300 to 3,000 feet, where there is still sufficient light for vision.

No adult has been taken in an oceanographer's net, presumably because they are too agile to be captured in such manner. On occasion larvae and juveniles are brought up. The larva feeds on minute crustaceans among the plankton of the sea. The adult favors small shrimp-like animals, the euphausiids, which occur in enormous numbers in the Deep Scattering Layer. To gather these creatures the oarfish has a large number of long, spiny gill-rakers (42 to 58) which strain the water passing over the gills.

Only Deep Sea Filter-Feeder

The oarfish is thus an anomaly among deep sea teleosts, or bony fishes, since it is the only one known to be a filter-feeder. The others swallow food of large size in comparison with their own bodies, and have luminous fishing lures, and wicked-looking

VERY LITTLE IS KNOWN *of the life history and the habits of the oarfish, a strange inhabitant of the stygian depths of the open sea. In fact, no adult has been taken alive in a biologist's net, possibly because they are much too agile to be captured in such a manner. This specimen has been preserved in the Museum of The Marine Laboratory, University of Miami. (Walter R. Courtenay)*



teeth to obtain their prey.

The oarfish, on the contrary, has a small mouth, lacks teeth, and luminescence has never been observed. It is the longest known teleost fish; marlins and tunas are but sardines when length alone is considered.

ALTHOUGH DEAD WHEN WASHED ASHORE, *this oarfish showed a cut down but nicely healed tail. Apparently the oarfish can survive a loss of almost half of its body to a predator, such as a shark or barracuda. This specimen measured just less than five feet in length. Had it not been injured earlier in its life, it probably would have reached ten feet. (Walter R. Courtenay)*

Canada To Hawaii—By Drift Bottle

The first reported recovery on the Hawaiian Islands of a Canadian drift bottle took place on March 23, 1958, according to *Pacific Progress Reports* of the Fisheries Research Board of Canada. The bottle was one of 1,000 released by the Pacific Oceanographic Group of Nanaimo, B. C., August 26, 1956, and was picked up on the beach at Kaneohe Bay, Island of Oahu, north of the city of Honolulu.

The recovery indicates that the drift bottle was caught in the main stream of the southward-flowing California current, which gradually turns at about latitude 30°N to form the North Equatorial Current, flowing westward across the Pacific Ocean. The direct hypothetical drift path is estimated to be 2,400 miles long, but it is most probable that the bottle meandered over a longer distance.

NAMEPLATE ON THE BOW OF THE Vityaz. *The upper lettering is the name in Russian; below it is a phonetic spelling in Polish. In English it is generally spelled* Vityaz, *but has also been spelled* Vitiaz *and* Witjaz. *(U. S. Coast and Geodetic Survey)*

Marine Science, Soviet Style

By HARRIS B. STEWART, JR.
Oceanographer, U. S. Coast and Geodetic Survey

RUSSIA APPEARS to have mounted an all-out attack on the oceans. The status of the "cold war" is constantly before us in the press, but few people are aware of the "wet war" in which she has quietly and efficiently been putting an ever increasing number of scientists and ships to sea, in quest of oceanographic information.

Data on the number of Soviet ships carrying out oceanographic surveys are incomplete, but officially the number is listed at about twenty, although unofficially they are believed to have at least twice this number. Their largest purely oceanographic ship, the *Mikhail Lomonosov,* has a displacement of 5,960 tons, over twice the size of the *Rohoboth* and *San Pablo,* largest operated by the Navy Hydrographic Office, and dwarfing such vessels as the *Baird, Gerda, Horizon, Atlantis,* and *Vema* on which has been done so much of this country's oceanography in recent years.

An Impressive List

Russia's nine main oceanographic ships and their tonnages are:

Mikhail Lomonosov 5,960

Vityaz	5,546
Pole	5,000
Sevastapol	3,000
Diamond	1,500
Equator	1,500
Lena (icebreaker)	12,000
Ob (icebreaker)	12,000
Okean	3,000

An oceanographic Soviet submarine, with three viewing ports in the bow, is in operation, and a nuclear-powered icebreaker is even now undergoing sea trials. In addition they have an unknown number of smaller ships also doing some oceanography.

Details on the size of their fleet of ocean-going research ships may be incomplete, but last December American oceanographers for the first time had a chance to look into every nook and cranny of a big Soviet oceanographic ship, to talk with her scientists, and to investigate the equipment used in a full-scale program to gather information on the geology, physics, chemistry, and biology of the seas.

Visit of the Vityaz

On the morning of December 17, 1958, the Soviet research ship *Vityaz* making about 12 knots steamed under the Golden Gate Bridge and entered San Francisco Bay. The red Soviet flag flew from her mainmast, and a prominent yellow hammer and sickle, on a broad red band, showed on her stack. On the wings of the bridge, and here and there along the rail, stood groups of Soviet scientists and crew members, eagerly taking their first look at the United States.

This was the fourth IGY cruise of the *Vityaz* and her first into the northwest Pacific. Leaving Vladivostok she had worked up to the Aleutian Islands, then south to 35° N and back up into the Gulf of Alaska. They then made a series of sections perpendicular to the west coast of North America, stopping at Vancouver and now at San Francisco. They planned to continue their offshore sections south to the latitude of Hawaii, then west to Honolulu and on across to Japan and back to the *Vityaz's* home port of Vladivostok.

Built in Germany

The *Vityaz* is a big ship. She is 363 feet long with a 43-foot beam. She is of steel construction with a wooden main deck. Originally built as a combination cargo and passenger vessel in Germany, she is now solely and totally an oceanographic research ship carrying sixty-seven scientists and an equal number of crew. The expedition director on this cruise was Dr. Nikolai Nikoliavich Sysoyev, Deputy Director of the Institute of Oceanology of the Academy of Sciences of the USSR, a short, solidly-built man with a round pleasant face, thinning light hair, and a winning smile. He knew no English but spoke through an interpreter, Aleksandra Abranovna Pavlova, wife of the Deputy Director of the Expedition.

Women Crew Members

Unlike American research ships, the *Vityaz* had numerous women aboard. Some like Dr. Zinaida Filatova and Olga Koblentz-Mishke are competent recognized biologists,

DR. NICOLA NICOLAIAVICH SYSOYEV *(left), Director of the* Vityaz *Expedition and Deputy Director of the Institute of Oceanology of the Academy of Sciences of the U.S.S.R. and his interpreter, Aleksandra Abranovna Pavlova, wife of the Deputy Director of the Expedition, talk in his cabin with the author and Dr. John Lyman, of the U. S. Navy Hydrographic Office. (U. S. Coast and Geodetic Survey)*

others like Nadezhda Skornyakova were what they called junior scientific workers.

About fifteen women were listed as crew members. These were primarily waitresses and cabin stewardesses, but one was listed as a bar stewardess. These women were generally short and husky-looking, wearing plain colorless and, by our standards, poorly cut dresses or suits. But all were friendly and proud of their ship and their work.

They had reason to be proud of their ship too, for in addition to having comfortable staterooms, carpeted corridors, and curtains — even in the laboratories — the *Vityaz* also carried a large assortment of oceanographic equipment. Some of this gear was the same as that used by our oceanographic ships. They had, for example, standard Nansen bottles and deep-sea reversing thermometers racked on the forward deck. Their plankton nets made of perlon, a German nylon, were much like ours, and they had a Russian-made version of our Isaacs-Kidd midwater trawl for sampling the larger animal life.

Duplicates of U. S. Equipment

A bottom-life sampler was very similar to our clam-shell sampler, and some of their remote recorders

were exact duplicates of American equipment. One of these was connected to a towed thermister unit quite comparable to our Thermitow, but they used British echo sounders, German pitch and roll indicators, and Japanese thermometers.

It was the purely Russian equipment, however, that most interested the American oceanographers who went aboard. For example, her deep-anchoring gear enabled the *Vityaz* to anchor in water depths up to 9,600 meters. No American oceanographic ship has comparable equipment. For this deep anchoring they have below deck a large drum carrying 13,600 meters of tapered cable that is fed over the large prominent sheave on the bow.

DROOPY-NOSED BOW *carries a large sheave, used for deep anchoring. The* Vityaz *has been anchored with this gear in record depths of 9,600 meters, in the Kuril-Kamchatka Trench. (U. S. Coast and Geodetic Survey)*

Loaded with Winches

Winches are really the *sine qua non* of an oceanographic ship, and the *Vityaz* is loaded. In addition to the deep-anchoring winch, they have a trawling winch with 15,500 meters of cable step-tapered from 15 mm diameter down to 8.5 mm. She also carries eleven other smaller winches for coring, plankton and ichthyological tows, water samples, optical measuring gear and the like. One of these on the forward deck was called a "geologic winch" and carried 12,000 meters of wire rope tapered from 6.2 mm diameter down to 4.65 mm.

Using these winches, the Soviets claim they can have up to three cables over the side at one time, something the Americans have not been able to do from their smaller ships. This way the Russians save the time that we consume in changing instruments on the end of a cable, for they merely haul in the cables on the port side, turn the ship around, and lower three more from starboard with the instruments already attached.

Vertical Temperature Profiles

For the vertical temperature profiles the Soviets used a remote recording bathythermograph that operates on the principle of resistance thermometry. It is lowered by the conductor cable to a depth of 350 meters,

and the temperature and depth are remoted to a recorder in one of the twelve laboratories aboard.

A so-called "hydroacoustic depth indicator" is a battery operated signal generator that they attach to their plankton and fish nets and trawls, and which transmits to the shipboard recorder the depth at which the nets are being towed. This has been successfully used, we were told, to depths of 2,000 meters, at speeds up to four knots with an accuracy of one per cent.

Measures Bottom Currents

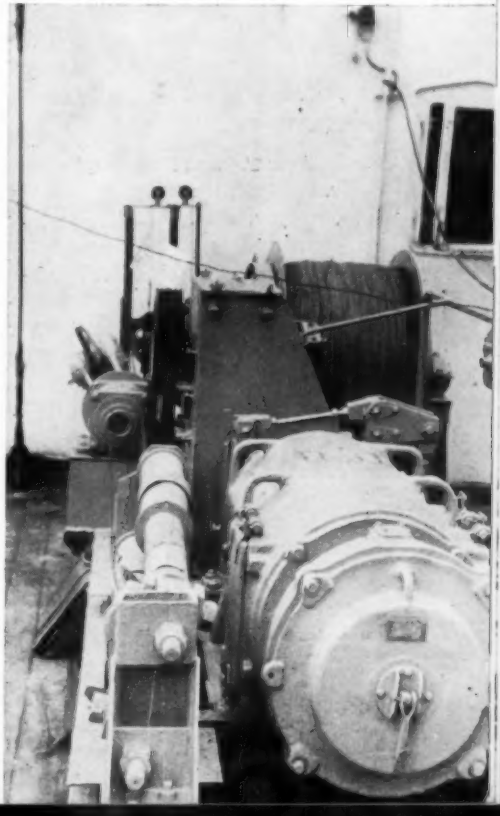
One of the large gravity corers had a small anemometer-type current meter in a cage at the top. This is locked during the lowering and recovery of the corer, but is free to turn while the corer is in the bottom —thus giving an indication of the current speed right at the bottom where the core is obtained. An interesting self-contained current meter (the Alexeev current self-recorder), suspended from an anchored buoy, has been used by the *Vityaz* to measure currents as deep as 1500 meters.

Instrumentally, some of their gear is inferior to ours, the greatest proportion comparable, and some considerably better. But what sort of results were they obtaining with this large ship, all these people, and all this equipment?

Symposium Held

The Soviets could not have been more cooperative in sharing their results with the American oceanographers. On the morning of their third day in port they held a symposium in the lower lounge, presenting prepared papers on some of their results to date. The lounge was normally used for recreational reading or study. A small Russian built television set was recessed into the forward bulkhead. One wall carried framed portraits of the Supreme Council of the Soviets, while opposite was a large ornate plaque on which were mounted pictures of five of the people aboard who, as one of the Russians ex-

MOST IMPORTANT EQUIPMENT *for an oceanic research ship is good winches.* Vityaz *carries eleven of them. This one is used primarily for coring and deep-sea photography. It carries 12,000 meters of wire rope which tapers from 6.2 mm diameter down to 4.6 mm diameter. (U. S. Coast and Geodetic Survey)*



REMOTE RECORDING BATHYTHERMOGRAPH. *This is the Soviet version of the BT, which records temperature with depth. It is lowered on 350 meters of conductor cable, and the temperature and depth are tabulated on a graph in one of the ship's laboratories. (U. S. Coast and Geodetic Survey)*

plained, "had done very good works" —a sort of labor honor roll. For the symposium the walls were covered with graphs and plots of their results to date.

New Trench Near Fiji

Dr. Sysoyev, speaking through his interpreter, Mrs. Pavlova, told of the work the *Vityaz* had been doing in the deep trenches of the Pacific, of the new trench they found northwest of the Fiji Islands, and of their new record depth of 10,990 meters found in the Marianas Trench — "highest depth of the world ocean" was the way it was translated. He stated that they had trawled to depths of nearly 11,000 meters in the Tonga Trench and maintained that the fauna collected and the measured dissolved oxygen indicated that this and the other trenches investigated were not stagnant but that currents were active.

In the north central Pacific, using their Alexeev current meter, they recorded rotary tidal currents as deep as 1,500 meters, and plots of these interesting measurements were shown. They have taken good clear bottom photographs at depths as great as 6,000 meters using a bottom-tripped stereo camera with a strobe unit, and some of these on display showed what appeared to be manganese nodules.

Optical Properties of Sea Water

Mikhail Kozlyaninov, a serious young man in charge of their hydrooptical program, spoke of studies of the optical properties of sea water, and showed plots of their variation down to depths of 9,000 meters. He stated that as preliminary results they have found that the maximum transparency gradient is associated with the thermocline, or maximum tem-

perature gradient, and that optical properties can be used to define separate water masses.

Olga Koblentz-Mischke told of their work on the measurement of primary production. They have measured phytoplankton production rates from 0.3 to 10 milligrams per cubic meter per day, have found higher values in subtropical waters, and have concluded that neither light nor nutrient concentration is a limiting factor but that production is the result of "all the hydrological conditions."

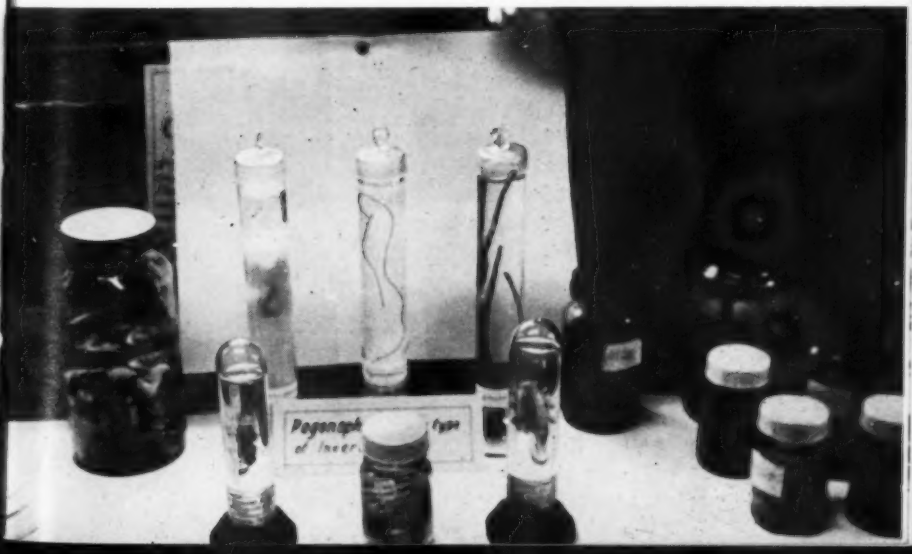
After Lunch, To Scripps

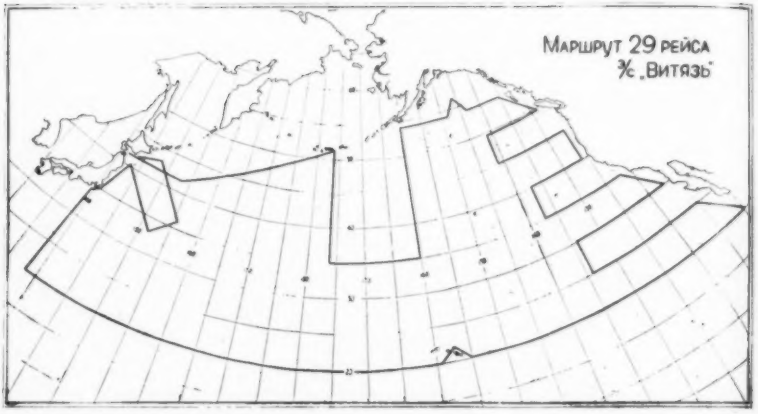
Their plankton investigations were discussed in English by a tall stately Russian in a neatly trimmed beard, Konstantin Vladimirovich Beklemishev. Using closing nets on deep vertical tows at nineteen stations in the Pacific, they have worked out a relationship between the standing crop at the surface and at depth and have found this to be one hundred times less at 4,000 meters, and at 8,000 meters it was only one one thousandth of the surface value.

After a lunch of red caviar, sardines, Russian crab, vodka, ground meat with a fried egg on top, more vodka, fruit, and Russian chocolates, ten of the Soviet scientists and some twenty American scientists flew to the Scripps Institution of Oceanography at La Jolla.

Here they inspected a typical American oceanographic station, talked with their U. S. counterparts, and continued the symposium. They described the new trench they had found, talked of their recovery of specimens of *Pogonophora,* a strange tube-like animal, which they had discovered off the Oregon coast, and discussed the distribution of the oxygen minimum layer and of their ichthyological investigations in the north Pacific.

FOR THEIR AMERICAN VISITORS, *Soviet scientists prepared a special exhibit in one of the twelve laboratories aboard the* Vityaz. *The three tall jars contain specimens of* Pogonophora, *a tube-like invertebrate recently discovered, and the first recovered from off the coast of North America. (U. S. Coast and Geodetic Survey)*





TRACK CHART OF THE Vityaz's *fourth IGY cruise, the one which took her to San Francisco. Previous Russian cruises were concentrated in the southwest Pacific. Note the wide swing south of the Aleutians, and the zig-zag course pursued along the west coast of North America. (Institute of Oceanology, U.S.S.R.)*

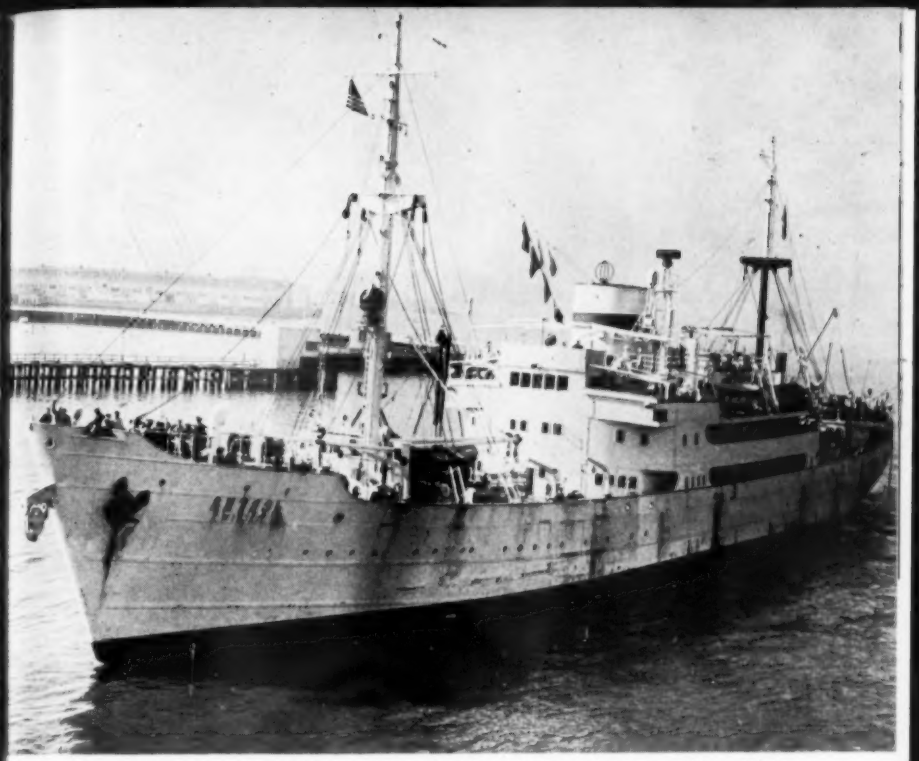
The American oceanographers were especially interested in the Soviets' ability to do so many oceanographic projects at the same time from one ship, and apparently doing them well. This all-out assault is considerably different from the American approach. Our philosophy, in part dictated by comparatively limited funds, is to mount a shorter oceanographic expedition on a smaller ship, using fewer people with one major project in mind. An American oceanographic expedition may be primarily to study the sub-surface currents in the equatorial Pacific, the bathymetry and subsurface structure of the Puerto Rico Trench, or the distribution of fish larvae in the Gulf of Maine.

Other Phases Squeezed In

Other phases are squeezed into the schedule only if there is time or if there is a strong-willed biologist who can wrangle time from the marine geologists, or a tyrant of a physical oceanographer who can persuade the biologists interested in fish larvae to make some casts for deep temperatures and salinities.

Our basic system of smaller ships with one main mission is, perhaps, a more refined and sophisticated technique. We take the available facts, formulate a theory or at least a multiple working hypothesis, and then put to sea to the area where the theory can be proved or disproved. But, someone always says, we must first have the data to formulate the hypothesis, and this is what the Russians on ships like the *Vityaz* are securing.

This, too, is what the United States somehow must do. As the recently published report of the National Academy of Sciences-National Research Council's Committee on



SOVIET OCEANOGRAPHIC SHIP Vityaz *approaches her dock at San Francisco. This is the first Soviet oceanographic ship ever to visit the United States. The author, along with oceanographers from other American government and academic agencies, was aboard her as an invited guest every day for the five days in port, but did not stay overnight. (Photo by Joe Rosenthal,* San Francisco Chronicle)

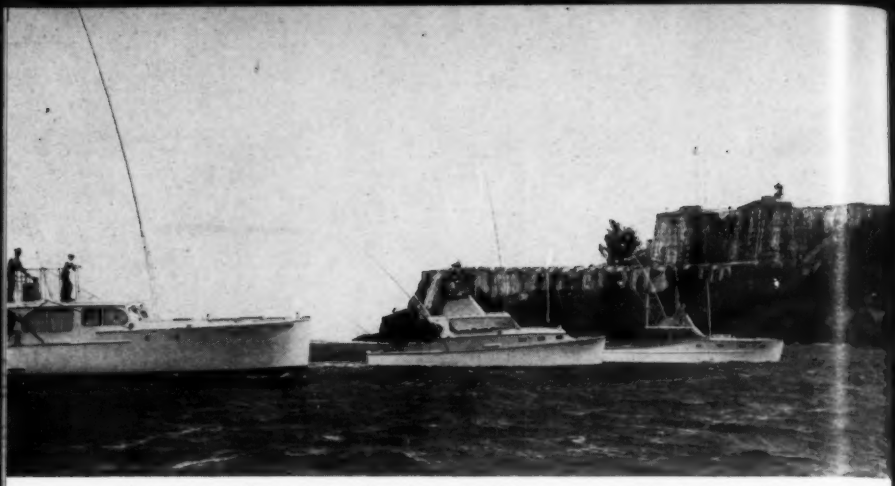
Oceanography has pointed out, we must couple increased basic research in oceanography with a new program of ocean-wide surveys, or this country might well be placed "in a precarious position from the scientific, technological, and military points of view."

Dual Mission?

Was the work of the *Vityaz* in the Pacific all oceanographic research and survey, or were their ulterior military or propaganda motives? From examining the ship, talking with the scientists, and learning the preliminary results of their work, it appeared that the *Vityaz* was doing exactly what she claimed to be doing: working hard at collecting good basic geological, physical, chemical, and biological information from the sea.

However, the scientists and crew were not allowed to forget that Russia has a mission other than oceanography, for in the lower lounge, where the symposium was held, was a large plaque bearing a bas relief of Lenin with a quotation in Russian:

"In order to spread world communism it is necessary to use the fields of science and technology."



A TRIO OF "SEA QUEENS" *salutes El Morro, venerable Spanish fortress at the entrance to the harbor of San Juan, Puerto Rico. These trim charter boats are typical of the facilities now available for sports fishermen and scientists in the waters surrounding the island commonwealth. (Photo from D. S. Erdman)*

Puerto Rico Game Fishing

By DONALD S. ERDMAN AND ERL ROMAN

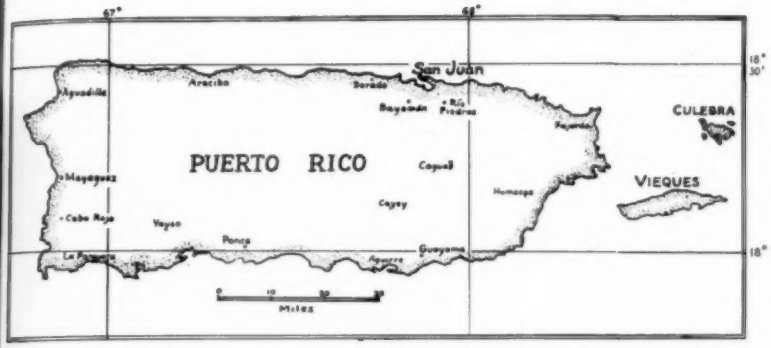
MANY WISE, and sometimes caustically witty comments have been made about angling and anglers. Certain it is, however, that angling is a friendly sport, and nowhere is it more friendly than in Puerto Rico.

That Puerto Rican waters have not been scientifically explored to the extent of those along continental United States, adds zest and an opportunity to combine sports fishing with research in the blue seas that envelop this beautiful West Indian island.

Over 400 Species of Fish

In fact, more than 400 species of fish are already known from Puerto Rico's inshore waters, of which 70 can be considered as game fishes. Seas descend to great depths not far from the island, with the prospect always of both anglers and scientists bringing up something that will add a new page or two to marine biology. These depths culminate in nearby Milwaukee Depth, 30,246 feet straight down, the deepest spot in the Atlantic, which oceanographers have been considering as a possible site to drill through the earth's upper mantle.

In September, 1958, Puerto Rico was host to a sizeable delegation of sports fisherman and fisherman-scientists, attending the fifth annual Puerto Rican Invitational Game Fish Tournament at San Juan, the capital. Its hotels and resorts offered a wide



WHILE PUERTO RICO IS SMALLER *than Rhode Island, it has more than 300 miles of palm-fringed coastline. Over 400 species of fishes are known in its coastal waters, of which 70 can be considered game fishes. There is no closed season, bag limit, nor fishing license, even in fresh water. (Map by J. Randall)*

choice of accommodations and the day before the actual fishing started in the tournament, there was a "get together party" at the Club Nautico de San Juan, host club of the tournament. It was attended by all the teams listed to compete, tournament officials, and committee members. They were welcomed by the club commodore, Charles D. Conway, and Esteban A. Bird, coordinator and president of the tournament.

Many Clubs Represented

Clubs represented in the tournament included the Sailfish and Tarpon Club of Mexico; the Arrecifes Yacht Club and the Playa Grande Yacht Club of Maiquetia, Venezuela; Sailfish Club of Florida, West Palm Beach; Montauk Yacht Club, Montauk, N.Y.; Texas Game Fishing Club, Dallas, Texas; Brielle Marlin and Tuna Club, Manasquan, N. J., Rod and Reel Club, Miami Beach; National Capitol Game Fish Conservation Club, Washington, D.C.; Ocean City Light Tackle Club, Ocean City, Md.; Eastern Airlines Flying Fisherman's Club, the U.S. Army, U.S. Navy, and U.S. Air Force.

In addition to the Club Nautico de San Juan, other Puerto Rican clubs were represented. These included San Juan Yacht Club, Miramar Fishing Club, Metropolitano Fishing Club, and the Lobos Fishing Club, all of San Juan; Arecibo Yacht Club, Arecibo; Club Nautico del Oeste, Mayaguez; Humacao Fishing Club, Humacao; and Ponce Yacht and Fishing Club, Ponce.

Twenty-two Blue Marlin

There were four days of tournament fishing, with a break on the third day for luncheon at El Baranquitas, 25 miles southwest of San Juan at an elevation of 2,500 feet. Fishing started at 9 a.m. and the fish were weighed in at 6 p.m. During the four days 22 blue marlin, a yellowfin tuna, a sailfish, and a wahoo were taken. Altogether during the tourna-

ment, not including boated fish, there were 108 blue marlin strikes, 14 sailfish strikes, and 24 broken lines or leaders.

The National Capitol Game Fish Conservation Club won the tournament with a score of 1,349.5 points and was awarded the Schaefer Cup. Club Nautico de San Juan came second, and Playa Grande Yacht Club placed third. Jim O'Donnell, captain of the winning team, topped the individual prize winners. His 304 pound marlin brought him the Angel Ramos Trophy for the biggest fish and the Eastern Air Lines Trophy and Department of Tourism Trophy for the best billfish. He also won the Pan American Airways Trophy for the high point score.

World's Record Blue Marlin

The high catch of blue marlin in the tournament is undoubtedly a reflection of the abundance of this magnificent game fish in the waters off San Juan. Over 500 blue marlins have been caught by sports fishermen with rod and reel since the sport started in 1950 in Puerto Rico. In 1958 alone, 140 were caught. Three were taken in one day off San Juan, on August 2, 1958, by Angel Abarca,

WELCOME ABOARD! *A big (196-pound) blue marlin is finally brought in after a two and a half hour battle. Caught by Dr. Carlos Iturriza, of the Playa Grande Yacht Club of Venezuela, it was one of 22 blue marlin taken during the Fifth Annual Puerto Rican Invitation Game Fish Tournament in 1956. Many of the larger specimens were examined and measured by scientists from The Marine Laboratory, University of Miami. (Puerto Rico News Service)*

THIS SLEEK PRIZE *is a spearfish* (Tetrapterus), *caught off San Juan, Puerto Rico, by Robert E. Maytag, a member of the board of trustees of the International Oceanographic Foundation. Occasional spearfish have long been taken in the Western Atlantic, but were considered to be only "odd" sailfish. Dr. C. Richard Robins, of The Marine Laboratory, University of Miami, was one of the first to recognize the true identity of these fishes, and has studied them for several years. A scientific paper resulting from this study is now in preparation. (Photo from D. S. Erdman)*

Jr. The world's record for rod and reel is a 756 pound blue marlin caught off Puerto Rico on April 19, 1956, by Allen Sherman.

Longline, Small Boat

After the fourth Game Fish Tournament at San Juan in 1957, participant Robert E. Maytag decided to try setting a longline from his twin-screw 35 foot vessel *Bimini Babe*. There is little commercial fishing for tunas, billfishes, and dolphins in Puerto Rico, and it was hoped that the use of commercial gear from a small sports fishing vessel might help to provide fuller, more exact information about the numbers and distribution of large pelagic fishes of the island, information of especial interest to science. Robert Maytag borrowed a longline of nearly a mile, with 87 9/0 hooks, from local sportsman A. C. Bob Reuter. The line was soft-lay nylon, 5/32 inch in diameter, with 1/8 inch nylon droppers. Inflated inner tubes were used as floats every 10 hooks.

Nice Haul Taken

The line was set off San Juan on eight days during the period October 29 to November 13. A crew of two helped with the setting and hauling of the line, and on some days Mr. Maytag was assisted by the senior author, or by Dr. John E. Randall of The Marine Laboratory, University of Miami.

The line was allowed to drift two to three hours, and the hooks, which were baited with balaju (ballyhoo or halfback), fished at an estimated depth of 15 to 30 fathoms. Twenty-five fishes were caught, including two blue marlins. Also taken were white marlin, sailfish, wahoo, dolphin, yellowfin tuna, barracuda, handsaw fish *(Alepisaurus)*, and three species of sharks.

Three days of longline fishing with an average of 72 hooks from Art Wills' *Sea Queen III* off San Juan in the period October 21 to 24, 1958, and three days from Bob Reuter's *C-Brave* off Aguirre and Grappler's Bank off Guayama from December 1 to 3 resulted in one blue marlin, two yellowfin tunas, one almaco jack, one barracuda, and eighteen sharks. On several of these days fishing was interrupted by sharks, and only on December 3 was the catch free of shark damage.

Food of Pelagic Fishes

The senior author (Erdman) has been studying the food habits of pelagic game fishes in Puerto Rico for four years as part of the research on the sports fisheries of the island provided by the Dingell-Johnson Act. The stomach contents of over 700 specimens have been examined.

The most important food items of the blue marlin with respect to volume are the tunas, especially the frigate mackerel *(Auxis thazard)*. Other fishes found in the 105 blue marlins examined include needlefishes *(Tylosaurus, Ablennes)*, round robins *(Decapterus)*, scads *(Selar)*, flying fish (only one found—this a 1½ inch specimen from a 176 pound marlin taken on February 21, 1959), little dolphin *(Coryphaena equiselis)*, baby swordfish *(Xiphias)*, snake mackerels *(Gempylus)*, black swallowers *(Pseudoscopelus)*, and the pelagic young of certain reef fishes, especially the plectognaths and surgeonfishes.

Even Eat Birds!

Of the plectognaths the most common is the filefish, *Amanses pullus*. The pelagic young of this species, one to three inches in length, is the most common food organism of all of the pelagic or open sea game fishes off Puerto Rico. The larval surgeonfishes *(Acanthurus)*, transparent with silvery abdomens and only about 1½ inch in length, seem surprisingly small prey for large blue marlin. Quite a contrast to a 23 pound squid, which was removed from the stomach of a 383½ pound blue marlin. Perhaps the strangest blue marlin food item was a black petrel (a sea bird) found in a fish taken off South Caicos, near the Bahamas.

Dolphins Favor Flying Fish

The white marlin is more prone to eat squids than the blue, judging from the fifteen specimens (eight from the Bahamas) which were examined. Small squids were found in four Puerto Rico white marlins and in five Bahamas fish. One marlin contained octopus. Fishes from white marlin stomachs included snake mackerels, surgeonfishes, filefishes, triggerfishes, blue runner *(Caranx chrysos)*, tuna (one young specimen), big-eyes *(Priacanthus)*, black swal-

A HOOKED BLUE MARLIN *breaks water off San Juan in a desperate struggle to get free. The world's record Atlantic blue marlin, a 756-pounder, was caught off Puerto Rico by Allen Sherman. Sports fishermen are cooperating with marine scientists by taking measurements of catches and keeping records as to dates and places. These data provide important clues to migrating sea life, especially of the rarer pelagic or deep water fishes. (Puerto Rico News Service)*

lowers, round robins, and a bramid.

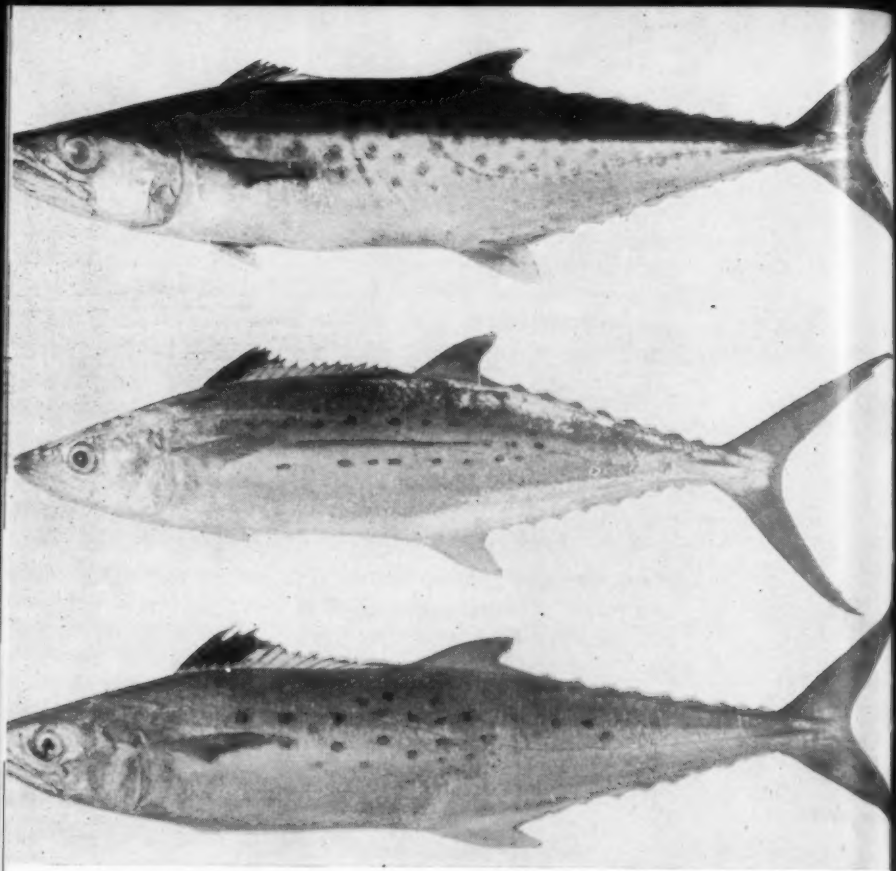
The stomachs of eleven Puerto Rico sailfish were opened and found to contain needlefishes, squids, halfbeaks, frigate mackerel, false albacore, flying fishes, round robin, blue runner, filefish, triggerfish, and bigeye. Flying fishes proved to the most important food of dolphins.

The pelagic young squirrelfishes and goatfishes are abundant in the stomachs of oceanic bonitos in spring and again in autumn. This may in part be responsible for the large schools of bonitos which occur near Puerto Rico coasts during these times of year.

Fishing Best by Season

Visitors from temperate areas in winter are impressed with the warm climate they encounter in tropical Puerto Rico. Some believe that there are no seasons at all in the island. But Puerto Rico lies at 18° north latitude and does have a noticeable seasonal change, albeit slight by contrast to most of the continental United States. The changing seasons are reflected in average monthly sea surface temperatures, which vary from 78° F. to 83° F. Whether for this reason or for others, it is obvious to resident fishermen that fishing for any one kind of fish in Puerto Rico is usually better at some times of year than others.

Blue marlin are caught in Puerto Rico in every month, but fishing for large ones is best in summer. In October one can expect a big run of smaller marlins. There is a fall-off in blue marlin abundance in November and more so in December. A similar situation obtains in Cuba where commercial marlin fishermen have noted that fishing slacks off with the appearance of the first north winds, as early as the end of October. although usually later. They speak of July to September as the months of "la corrida de los peje grandes" (the



THREE FISH "LOOK-ALIKES." *Upper, a 16-inch kingfish* (Scomberomorus cavalla), *which is spotted when young. Middle, the painted mackerel or cero* (S. regalis), *common along inshore Puerto Rican waters. Lower, the Spanish mackerel* (S. maculatus) *probably does not occur in Puerto Rico at all, but is included here to provide comparison with the other two species, with which it has been confused at times. (Frank McFerran and L. P. Thomas)*

run of the large fishes).

Fishing for white marlin, on the other hand, is best off San Juan in April, with May also a good month. The best month for sailfish fishing off San Juan has been November.

The scombroid fishes, yellowfin tuna, blackfin tuna, oceanic bonito, and wahoo, are commonly taken offshore in Puerto Rico. The best months for yellowfin have been May, June, and July. There is a small commercial fishery for these big tunas at Aguadilla. October and November have been the best months for wahoo fishing. Wahoo seem to bite best during calm weather.

Dolphins or "Dorados"

The dolphin is a favorite game fish for many an Izaac Walton devotee. Although not as ponderous as

the billfishes, it makes up for its smaller size in sheer fighting ability, at times leaping high out of the water. Known as "dorado" in Spanish-speaking areas, its rich golden color undergoes an alteration to silver as it thrashes violently after being boated. Its green hues change to blue, and its sapphire spots seem to flash on and off. The panorama of color change of a dying dolphin is an unforgettable sight.

At times dolphin are present in great numbers in Puerto Rican waters, especially from January to April. February appears to be the best month for dolphin fishing. On one day of this month in 1956 seventy-six were caught from one boat off San Juan. The average weight of these fish was 10 to 15 pounds. Weights up to 50 pounds are not uncommon for Puerto Rico dolphin, however.

Where to Find the Jacks

Trolling in more inshore waters may result in the catching of such fishes as the barracuda, painted mackerel, and kingfish. Fishing for the latter is especially good in Vieques Sound in May. Off La Parguera and San Juan the summer months appear to be the best for catching kingfish. Young kingfish are spotted like the Spanish mackerel and painted mackerel, and are sometimes misidentified. The Spanish mackerel appears to be absent from Puerto Rico waters, however. Various groupers and snappers are readily taken by bottom fishing around the island.

Snook and Tarpon

Snook and tarpon occur in Puerto Rico too. Fishing for the former is said to be best after the first spring rains, especially near the mouths of

NOT ALL FISHERMEN *in Puerto Rico are sportsmen. Although the Commonwealth imports large quantities of dried fish from Nova Scotia and Newfoundland, it also has its own small fishing industry. Typical of Puerto Rico's rustic fishing ports is Las Croabas, near Fajardo, at the northeastern tip of the island. (Puerto Rico News Service)*

rivers, such as the Boca Vieja. Tarpon are common in San Juan Harbor, Mayaguez, and elsewhere. Tarpon over 200 pounds have been caught at the mouth of the La Plata River and Rio Grande de Loiza, both on the north coast. A 111½ pound fish was caught on 80 pound test line by José M. Matienzo.

Even spearfishing has its best season. The best time is August through early November when the water is usually calmer than during the rest of the year. The clearest waters are around such offshore islands as Mona, Desecheo, Culebra, and Vieques.

Everyone who has visited and fished in the Puerto Rican area, whether he be scientist, game fisherman, or just plain angler, agrees that these waters are among the most promising and most prolific in the West Indies. It is good to know that measurements of catches and the keeping of records are being stressed. These will provide important clues to migrating sea life, and help to fill in many chapters now blank in the logbooks of both scientist and angler. They may also add to our knowledge of the migrations of pelagic fishes over a wide area.

Fishery Meetings in Bahamas

The 12th Annual Meeting of the Gulf and Caribbean Fisheries Institute and the 4th International Game Fish Conference will be held at the British Colonial Hotel, Nassau, Bahamas, from November 9 to 13, 1959. The Gulf and Caribbean Fisheries Institute has developed into one of the important international fisheries meetings of the world.

Sessions are planned this year on shrimp fisheries, menhaden fisheries, Caribbean fisheries and on biology and exploratory fishing. As usual, wide representation is expected at the meeting of industry people, scientists and administrators from many countries.

Anglers Participate

The International Game Fish Conference, which is sponsored by the International Oceanographic Foundation, has a similar function, to provide a meeting place for marine anglers and fish scientists. Papers will deal with research in game fisheries and opportunity will be provided for discussion of problems. The general public is invited to attend.

The Gulf and Caribbean Fisheries Institute is sponsored by The Marine Laboratory of the University of Miami. No formal membership is needed in order to attend either meeting. All interested persons are invited to participate, and to benefit from the very favorable convention rates at the hotel.

Inquiries may be addressed to the Executive Secretary of the Gulf and Caribbean Fisheries Institute or to the Executive Secretary of the International Game Fish Conference, both at No. 1 Rickenbacker Causeway, Miami, 49, Florida.

Science of the Sea in BOOKS

For General Reading

HURRICANE

MARJORY STONEMAN DOUGLAS. Rinehart and Company, Inc. New York. 1958. 393 pages, including bibliography and index. $5.95.

Of all natural phenomena the hurricane (and its oriental cousin, the typhoon) is the most dramatic and the most devastating. Hurricanes have plagued parts of the Western World for centuries, yet many things about them remain deep mysteries. How are they born? What determines their often erratic courses? Can they be broken up or controlled? Why do they die?

It was inevitable that some day, some one would write a book compiling the available scientific and historical information and advance some theories and proposals as to what puny man might do about these monstrous and costly storms.

Such a book, and the best to date, is Mrs. Douglas's *Hurricane*, a beautifully written and well documented volume that includes photographs, sketches and a valuable bibliography of the writings of others on the subject, dating back to Las Casas' *Journal of the First Voyage to America by Christopher Columbus*. However, this is not a technical treatise nor a handbook for meteorologists; its primary appeal is to the intelligent layman.

Mrs. Douglas, a longtime resident of Florida, spent three years obtaining information on tropical disturbances with the Hurricane Research Project of the U. S. Weather Bureau. The fruits of this add solid information to some vivid descriptions of several great modern storms which struck not only tropical areas where they were born, but even such distant places as New England and Canada.

While making a strong plea for more funds to continue and expand greatly needed weather research in general and hurricane studies in particular, Mrs. Douglas debunks the oft-advanced notion that a hydrogen bomb might be used to "blow a hurricane to pieces."

"The answer to that," she contends, "is always that although the force of the hydrogen bomb is almost unimaginable, the forces released in and by any hurricane are so much greater, clearly beyond the grasp of the average mind, that such a bomb would be no more disturbing to the colossal dynamics of the great spiral than one of its own minor eddies.

"Control of hurricanes might come, as precision forecasting may, when the weather scientists have had an opportunity to learn and measure exactly the complex of forces that triggers them — the formula for the vast cloudy heated-air machinery that keeps them going under the formidable movements of the upper air, which they begin to think are their supreme controls."

Mrs. Douglas's lengthy volume deserves a place on not only every reference shelf, but also on the living room table, where its excitement and values may be savored in a succession of delightful evening readings.

If the book has a fault, it is in the selection of photographs used as illustrations—too much journalistic depiction of storm damage and flooding, and not enough pictures of hurricane-hunting planes, weather

intelligence centers, radar equipment, and other weapons of man's counter-attacks.

And how *could* the editors have overlooked a hurricane "do-it-yourself" chapter, telling and showing householders, small boat owners and others what to do to minimize hurricane property damage, and prevent personal injury and loss of life? Perhaps this might provide addenda for subsequent editions of *Hurricane*, which are fairly certain to be forthcoming.

E.J.L.

SURF FISHING

VLAD EVANOFF. The Ronald Press Company. New York. 1958. 120 pages. $2.95.

Mr. Evanoff's book is most timely and welcome, not only for the beginner but also for the old timer who enjoys this very interesting and exciting type of angling. Surf casting has changed considerably within the past few years, and Evanoff's book describes and appraises many innovations in rods, reels, lines and lures. As most old hands at surf fishing will tell you, this branch of the angling sport is the biggest gamble in fishing. With the surf fisherman it is either feast or famine. If he happens to be at the right place at the right time, nearly every cast will bring in a fish, provided he knows how to cast, has the proper tackle and is using the proper bait or lure. Guessing where and when fish will be running the surf is a difficult trick to learn. However, a good surf fisherman is able to make a better go of it than the average person would think possible and to garner some very respectable catches.

In *Surf Fishing*, Evanoff includes some excellent tips for catching the more popular surf-running fishes, and the book is well illustrated from cover to cover with helpful pictures and drawings. To the beginner the book is a must. For the experienced surf fisherman it will offer enjoyable fireside reading and possibly provide him with new and useful ideas. E.R.

THE STORY OF THE GRAY WHALE

RAYMOND M. GILMORE. Cabrillo Historical Association. San Diego 6, California, 1958. 16 pages. 35c.

Although small in size (with matching price) *The Story of the Gray Whale* is packed with sound information, and has some exciting photographs, excellent sketches and a map showing the distribution and migration of this not-too-well-known Pacific mammal. The author, who is research curator, Marine Mammals, San Diego Museum of Natural History, spent five years studying the California Gray Whale, to use its full name, for the U. S. Fish and Wildlife Service. He therefore is not only qualified to speak with the authority, but he does so in clear lucid prose, easy for the layman to understand. No "whale library" is complete without this compact booklet. E.J.L.

Technical

DYNAMICAL AND PHYSICAL METEOROLOGY

GEORGE J. HALTINER AND FRANK L. MARTIN. McGraw-Hill Book Company, Inc., New York, 1957. 470 pages.

Almost all energy received by the ocean comes from the atmosphere. Furthermore, the dynamics of the atmosphere and the dynamics of the hydrosphere obey the same fundamental laws, and both meteorologists and oceanographers use the same mathematical apparatus. The oceanographer, therefore, always keeps a watchful eye on new developments in meteorology. Oceanographers are still awaiting a modern textbook in dynamical oceanography; the most recent, only about ten years old, is already out of date. It is most stimulating to find a modern textbook in dynamical and physical meteorology. The authors cover most of the topics in dynamical meteorology. They develop the theories to their fullest from the fundamental principles. The section on physical meteorology, which is rather restricted in scope, is primarily an introduction to the dynamical. The thermodynamics, radiation, moist air, and the heat balance are discussed.

In the section on the dynamics, special attention is given to turbulent flow and transport, circulation, frontogenesis, and to the perturbation theory. A special chapter on numerical methods in dynamic forecasting gives the fundamentals of modern weather prognosis.

With the exception of a few vector operations, which are developed in the first chapter, the mathematical treatment does not proceed bevond application of the usual calculus.

The authors have succeeded in presenting the most important subject of the meteorological field in a short and complete manner. The introductory chapters do not receive the same care as the advanced ones, but fulfill their purpose. The cited literature points the direction for further advanced study. This is an excellent textbook in meteorology and "must" reading for dynamic oceanographers. F.F.K.

PERSPECTIVES IN MARINE BIOLOGY.

EDITED BY BUZZATI-TRAVERSO. University of California Press, Berkeley & Los Angeles. 1958. 621 pp. $10.00.

In 1956, at a meeting held in La Jolla, it was hoped that the bringing together of experimentalists and field research men would result in better understanding of each other's needs and problems, and in better cooperation in the future. It is not the province of this review to comment on the success of this plan, or on the choice of representative speakers.

This volume contains the papers, about forty, presented at this meeting, together with a brief account of the resulting discussions. They are grouped under the headings, Ecology, Physiology and Biochemistry, Behavior, Genetics and Evolution. Marine Biology suffers badly from a lack of text books and comprehensive reviews. These papers represent the views of specialists of the current status of their particular fields, of outstanding recent developments, and of the needs for future work, as they see it.

Such a collection is of great value and names of the contributors, even if there are others whom one would like to see included, show a refreshing and stimulating array of views of people well qualified to speak. H.B.M.

About the Authors

DONALD S. ERDMAN

Mr. Erdman launched his piscatorial career at Cornell University, where he majored in fisheries and fish culture. Later he became scientific aid in the Fish Division of the U. S. National Museum, including an expedition to Saudi Arabia in 1948.

His experience with the Gulf and Caribbean area began in the Gulf of Nicoya, Costa Rica, 1951-53, followed by a cruise in his sloop *Booby* from Punta Arenas, Costa Rica, to Mayaguez, Puerto Rico, via Panama, Jamaica, Haiti and the Dominican Republic. This expedition was supported in part by the Chicago Museum of Natural History, for whom fishes and molluscs were collected.

Following an instructorship in Fishery Biology at the University of Puerto Rico, Mr. Erdman assumed his present work, as Fishery Biologist, Section of Fisheries and Wildlife, Department of Agriculture and Commerce, Commonwealth of Puerto Rico. He lives with his wife and daughters on board their sloop *Booby* at La Parguera, P.R.

HARRIS B. STEWART, JR.

Like many others of his era, Dr. Stewart's undergraduate studies were interrupted by World War II, during which he served for four years as an Army flying instructor and pilot in the southwest Pacific. Upon his return to Princeton, Professor Harry Hess, of the Geology Department, introduced him to the challenge of oceanography. Since then his career has included a year's duty on a Hydrographic ship, work in underwater geological mapping, and five years of oceanographic studies at the Scripps Institution of Oceanography, where he received his Ph.D., in 1956. Since 1957, Dr. Stewart has been with the U. S. Coast and Geodetic Survey, and is now in charge of the oceanographic programs of the Survey.

PAUL S. GALTSOFF

Much of Dr. Galtsoff's early life was spent in Imperial Russia, where he was graduated from Moscow University and became senior zoologist of the Imperial Academy of Sciences in St. Petersburg. Escaping from Russia during the Revolution, he came to the United States to work for the U.S. Bureau of Fisheries. Since 1951 he has been Director of the Shell-fishery Laboratory, and research biologist, U.S. Fish and Wildlife Service, Woods Hole, Mass.

In addition to publishing more than 200 scientific papers on both fresh water and marine life, Dr. Galtsoff has taken part in numerous field expeditions and important meetings, including the San Francisco Conference for the Organization of the United Nations, the Washington Whaling Conference, and the International Conference for the Protection of Fur Seals. He was an official observer at the Bikini A-bomb Tests.

Dr. Galtsoff is a member of the Board of Trustees of the International Oceanographic Foundation, and is a Trustee Emeritus of the Marine Biological Laboratory, Woods Hole, Mass.

New Small Boat Charts

The greatest change in nautical charts since the introduction of color in 1862 has been announced by the U. S. Coast and Geodetic Survey. Experimental charts, especially designed for use in the cramped quarters of the more than 7,000,000 small craft operated in the United States, are now available under four different formats, all of which cover the 100 miles of the Potomac River from Washington, D. C., to Chesapeake Bay. If the new formats are well received, similar charts will be prepared covering other important waterways. Comments from power squadrons, outboard and yacht clubs, and marine dealers are invited by the Coast and Geodetic Survey, Department of Commerce, Washington 25, D. C.

Progress

DURING THE FEW YEARS of its existence *Sea Frontiers* has reached a membership which has more than doubled every twelve months. Members are drawn from the United States, Canada, Central and South America, Great Britain, Australia, France, Germany, Italy, Turkey, Denmark, Sweden and Norway as well as a few from the Pacific Islands, the West Indies and Russia.

CONTINUED IMPROVEMENT will be possible with growth of active membership. It will be seen in better service, with more articles in the magazine of high interest and authenticity and, eventually, a monthly issue in full color.

IN ADDITION TO PUBLISHING *Sea Frontiers* and *Sea Secrets,* the Foundation provides active support for scientific research and education. The ocean is our last frontier and its exploration still under way.

MEMBERS are joined in these aims and they are urged to make progress possible by taking the small effort needed to enlist new members. Sample copies will be mailed to friends upon request.

INVITATION: Those who are not members, but whose interest and curiosity lie in the sea and the spirit of discovery, may participate by simply mailing the card in this issue.

THE EDITOR will be glad to consider for publication articles and illustrations covering explorations, discoveries or advances in our knowledge of the marine sciences or describing the activities of oceanographic laboratories or expeditions in any part of the world.

The International Oceanographic Foundation

"To encourage the extension of human knowledge by scientific study and exploration of the oceans in all their aspects, including the study of game fishes, food fishes, ocean currents, the geology, chemistry, and physics of the sea and the sea floor."

President	MR. CHARLES F. JOHNSON
Vice President and Secretary	DR. F. G. WALTON SMITH
Vice President	MR. R. HARDY MATHESON
Treasurer	MR. JOHN MAHONY

BOARD OF TRUSTEES

Admiral Leo O. Colbert
Mr. George Collier
Dr. Raymundo de Castro Maya
Mr. Allison Fleitas
Dr. Paul S. Galtsoff
Mr. Ernest Hemingway
Colonel John K. Howard
Mr. Charles F. Johnson
General Robert Wood Johnson
Dr. John Oliver LaGorce
Capt. E. John Long
Mr. John Mahony
Mr. John A. Manning
Mr. R. Hardy Matheson
Mr. Robert E. Maytag
Dr. J. L. McHugh
Mr. Al Pflueger
Mr. Erl Roman
Dr. Waldo Schmitt
Dr. F. G. Walton Smith
Colonel Frederic A. Wanklyn
Mr. Louis R. Wasey
Mr. Erik Wijk

COMMITTEES

Game Fish Research
Museum
Membership
Grants and Awards
Publications
Finance

MEMBERSHIP

The Foundation was established by a group of saltwater anglers, yachtsmen, shipowners, marine scientists and others interested in the scientific exploration of our last frontier, the ocean. Its objectives are to provide support and encouragement for marine research, exploration and discovery and to promote the collection and dissemination of scientific knowledge about the ocean.

Qualifications for membership are an interest in the oceans and a desire to extend and develop scientific reesarch and exploration into them. Support given to research through personal activities or donations is recognized by the Foundation through the following classes of membership. Members are those who make annual contributions of $5, Fellows $25 annually; Associates $100 annually; Life Fellows are those who contribute $200 or more or who have otherwise helped to advance the purposes of the Foundation; Sponsors who contribute $1,000 or more; and Patrons who contribute $5,000 or more. Corporate Associates contribute $1,000 annually.

According to a ruling of the U.S. Treasury Department, donations made to the Foundation are deductible in computing taxable income as provided for by the 1954 code.

Offices: The Marine Laboratory, University of Miami,
439 Anastasia Avenue, Coral Gables 34, Florida

PRINTED BY PARKER, CORAL GABLES, FLORIDA, U.S.A.